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OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

MAY, 1886.

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TRANSACTIONS

OF THE

~~THIRD ANNUAL MEETING~~

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION

HELD IN THE CITY OF NEW YORK

MAY 10 AND 11, 1886

NEW YORK
D. APPLETON AND COMPANY
1, 3, AND 5 BOND STREET
1887

OFFICERS, 1886.

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THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

The third annual meeting of The American Climatological Association was held in the hall of the College of Physicians of Philadelphia, on Monday and Tuesday, May 10th and 11th, 1886.

The opening session was called to order at 3 P. M. of the 10th by the President, Dr. William Pepper.* There were twenty-seven members in attendance. The minutes of the last meeting were read and approved.

Paper.

THE EFFECTS OF HIGH ALTITUDES ON CARDIAC DISEASES.

By ALFRED L. LOOMIS, M. D., LL. D.

CASE I.—In the summer of 1880, during my vacation at St. Regis Lake, in the Adirondack Mountains, I was requested to visit a gentleman who had just arrived from New York and was thought to be dying. I found a gentleman, forty years of age, sitting at an open window, gasping for breath, and deeply cyanosed. No distinct radial pulse could be detected, his extremities were cold, and his body was covered with a profuse perspiration; he was semi-conscious, unable to speak or swallow, and seemed to be dying. Neither heart-sound could be distinctly heard. After the hypodermic administration of ten minims each of tinct. digitalis and Mag. sol. morph., with the free use of hypodermics of brandy, he rapidly recovered from his extreme condition, and in a few hours was comparatively comfortable, but unable to lie down, and was only partially relieved of his dyspnœa, the radial pulse continuing rapid, feeble, irregular, and intermitting. The next morning I obtained the following history:

Three days before Mr. C. had left New York city feeling well, although for two or three months before he had noticed that he became easily

* In consequence of the late date at which Dr. Pepper's address was received, it has been found impossible to place it at the beginning of the volume. It will be found further on.

fatigued, had dyspeptic symptoms, lost flesh, and spent restless nights. When he reached Plattsburg the evening before (the altitude of which is 150 feet above sea-level) he felt better than when he left New York, slept unusually well during the night, and started at eight in the morning for St. Regis Lake. When he reached an altitude of about a thousand feet his breathing became difficult, and, as he reached higher altitudes, the difficulty increased and was accompanied by cardiac palpitation and a sense of oppression in the epigastrium. The dyspnœa and oppression became so urgent before he reached St. Regis (the altitude of which is about 2,000 feet) that his friends had to support him, and, when taken from the carriage on his arrival, he was thought to be dying. A careful physical examination twenty-four hours after showed a diffused, indistinct cardiac impulse; the area of præcordial dullness was greatly increased both to the right and left. The first sound of the heart could not be made out; its time was occupied by a loud systolic murmur. The pulse was rapid, feeble, irregular in force, and at times intermittent; fine râles were heard at the base of both lungs. One examination of his urine gave negative results. After treating him for three days, with little apparent improvement in his cardiac symptoms, I advised that he should be taken to a lower altitude.

When he reached Plattsburg on his return his dyspnœa was markedly relieved; when he reached his country home on the Hudson he had so far improved that he was able to walk on a level, and to lie down with his head and shoulders slightly elevated, although his dyspnœa, epigastric oppression, and irregular heart-action continued; his feet soon became œdematous, and six weeks later he died with general anasarca and heart insufficiency. No post-mortem examination was made. His family physician told me, some time after, that he had never detected signs of cardiac disease until his return from the mountains, although he carefully examined his heart two weeks before he started on his summer trip.

This case interested me greatly, and led me to observe more carefully than before the effects of high altitudes upon persons having cardiac insufficiency from any cause. The following brief histories are typical of several distinct classes of similar cases which have come under my observation since that time. My total number of recorded cases is now twenty-two.

Case II.—Mr. M., aged fifty-two, with recognized aortic insufficiency, which had never given him serious trouble (in fact, he was not aware that he had cardiac disease), on the 10th of August, 1882, started with his family on a pleasure trip through the Adirondacks. When he reached an altitude of about 1,000 feet he began to suffer with dyspnœa and cardiac palpitation; when he reached St. Regis Lake he was markedly cyanosed, his respiration was gasping in character, and his pulse could not be counted. His apex impulse was diffused and indistinct, and he was having quite pro-

fuse pulmonary hæmorrhage. I ordered a calomel purge, and ten drops of tinct. digitalis every three hours, which was followed by marked relief within twenty-four hours, although his dyspnœa and cardiac symptoms were not sufficiently relieved to allow him to lie down. A physical examination showed extensive cardiac enlargement, a diffused and indistinct apex beat, a feeble and irregular heart-action, an absence of the muscular element of the first sound, but no murmur could be detected. The urine contained albumin, but no casts; crepitating râles were heard over the base of both lungs. I advised that he return immediately to his home in Brooklyn, which he reached, the third day after, very much improved. His dyspnœa was so much relieved that he was able to lie down; his feet and legs soon became œdematous, general anasarca followed, and in two months he died suddenly. No autopsy was made, and I could get no intelligent account of the immediate cause of his death.

Case III.—Mrs. S., forty-three years of age, who had mitral insufficiency of more than ten years' standing (I had examined her ten years before), but who had never given any cardiac symptoms, having apparently been in good health, in June, 1883, started for Colorado to visit an invalid sister. Before she reached Denver—at an elevation of about 4,000 feet—she was suddenly seized with extreme dyspnœa, was taken from the train at Culbertson with a profuse hæmoptysis, had excessive palpitation of the heart and a sense of constriction in the chest, so that at times it was very difficult for her to inspire. The next day, having obtained but little relief from her urgent symptoms, she started on her return, unable to lie down, coughing almost constantly, and expectorating freely a frothy, blood-stained fluid. She gradually improved as she reached the lower altitudes, and when I saw her, immediately after her return home, she had no dyspnœa so long as she was quiet in a sitting posture, but the slightest exertion would bring on an attack of extreme dyspnœa, cardiac palpitation, and epigastric oppression. A physical examination revealed extensive dilatation of both ventricles, complete cardiac asystolism, an indistinct, diffused apex beat, crepitation over the base of both lungs, with feeble and, at points, absent respiratory sound. The pulse was rapid, feeble, irregular, and intermitting; there was slight œdema of the feet and ankles; no albumin or casts were found in her urine. She did not respond to treatment, and died four weeks after her return. At the autopsy both ventricles and auricles were found much dilated; there was old thickening and insufficiency of the mitral valves, with some interstitial myocarditis and degeneration of the muscular fibers of the heart-walls; the right lung was the seat of cardiac pneumonia and old infarctions. All the other viscera were in a condition of venous congestion.

Case IV.—Mr. B., aged forty-six, with aortic insufficiency and moderate eccentric hypertrophy, the existence of which was only known to his physician and one member of his family, he never having exhibited cardiac symptoms sufficient to attract attention to his heart. In July, 1884, he visited the Catskill Mountain House—an elevation of about

2,200 feet. After dinner on the day of his arrival he took a walk of about one mile, and on his return to the hotel was seized with great difficulty of breathing and vomiting; became cyanosed and unconscious. A physician saw him, and told his friends that he would hardly live through the night. The next morning he rallied, but continued to breathe with great difficulty. After remaining at the hotel three days, with little relief to his urgent symptoms, at his persistent request, his friends started with him for home. Before he reached the landing at the foot of the mountain his dyspnœa was much relieved and his condition greatly improved. The evening of his return to New York I saw him. His breathing was still difficult, and he was markedly cyanosed; his pulse was 140 per minute, feeble, irregular in force, and intermitting; his cardiac impulse was diffused, and the point of apex beat could not be determined. He was unable to lie down, and there was slight œdema of the feet; neither heart sound could be distinctly made out, there was complete asystolism, crepitations were heard over the base of both lungs, and albumen and casts were found in his urine. His condition became steadily worse, and he died at the end of three weeks. At the autopsy both ventricles were found very much dilated, and the walls of the left evidently hypertrophied. The aortic valves were thickened, indurated, and contracted; the heart-walls were the seat of chronic interstitial myocarditis, the kidneys were cirrhotic, and the lungs congested and œdematous. His physician told me that his urinary examinations had always given negative results before he went to the Catskills.

Case V.—Mr. H., aged twenty-six, with a well-marked syphilitic history and consolidation of the upper third of the right lung of one year's standing, was examined by me in June, 1885. His heart-action was feeble and irregular in force, but not in rhythm; half a dozen rapid full respirations would increase the number of beats ten per minute, and its action would become more irregular. The muscular element of the first sound was absent; no murmur could be heard. Feeling that it was not a safe heart for a high altitude, I advised him to spend the summer at Block Island. Another medical adviser recommended him to go to Colorado Springs, but he went to Las Vegas. His breathing became very difficult before he reached his destination. He was cyanosed, complained of his heart and a "great weight" in his epigastrium, "his feet began to swell," and he died on the seventh day after he reached Las Vegas. I was unable to obtain any other details of his last illness, except that his friends thought he died of heart disease.

Case VI.—I am indebted to Dr. E. L. Trudeau for the records of this case. Mrs. T., aged fifty, accompanied her son, who was in the first stage of phthisis, to St. Regis Lake in June, 1885. She had always been well, with the exception of a mild attack of articular rheumatism ten years before. Eighteen months before she had an attack of cardiac palpitation and fainting, for which digitalis was administered. She was not aware that she had any trouble with her heart. Very soon after her arrival at

St. Regis Lake she began to complain of epigastric oppression, cardiac palpitation, faintness, dyspnœa, and great prostration. On examination, both ventricles were found evidently dilated, and the heart-sounds were indistinct, with a soft systolic murmur at the base; the pulse was rapid, feeble, irregular, and intermitting; there was pallor, but no marked cyanosis or œdema. The urine was scanty, of high specific gravity, but contained neither albumen nor sugar. Under the use of digitalis and morphia hypodermically, and alcoholic stimulants, she rallied, and was comfortable for several days, but all her distressing symptoms soon returned, vomiting came on, her face assumed an anxious expression, the lips and finger-ends became blue, the pulse more rapid, feeble, and intermitting, attacks of syncope occurred, and she died in three weeks after the onset of the first unfavorable symptoms. No autopsy was made.

In the cases which I have related, as well as in all similar ones which have come under my observation, *the ventricular dilatation, which unquestionably was the cause of the sudden development of the distressing symptoms, and which dated the commencement of the fatal issue, seemed to be directly due to the effects on the cardiac circulation of the change from a low to a high altitude.* I do not maintain that sudden cardiac dilatation might not have developed in any one of these cases under other conditions, but I do maintain that change in atmospheric pressure is a very important cause of sudden ventricular dilatation when any degree of heart insufficiency pre-exists.

I desire now, as briefly as possible, to direct attention to the probable explanation of such occurrence, the condition of the heart under which it is liable to take place, and the dangers attending changes in atmospheric pressure, to those who give the slightest evidence of heart insufficiency from any cause.

It is a well-recognized fact that, if the resisting power of the cardiac walls is greatly impaired, an abnormal degree of blood-pressure may produce cardiac dilatation.

There are several important considerations which occur in this connection: 1, The rapidity with which the increased blood-pressure is established; 2, the vitality of the cardiac muscle; 3, the reserved force possessed by the cardiac walls.

It is evident that when the increased blood-pressure is quickly established, and is in excess of the reserved force of the ventricular walls, dilatation must result. I do not include in this statement those cases in which the pressure is so great as to paralyze the cardiac muscles and cause sudden death, nor those cases in which it is only of momentary development, for often temporary over-distension may be quickly and completely recovered from, even by a feeble heart

The occurrence of sudden or gradual cardiac dilatation, I am confident, may depend not only on unsoundness of the cardiac muscle, but upon the want of integrity in the cardiac nerve-supply. It is impossible to have permanent cardiac dilatation if the *cardiac muscle* is *sound* and the *innervation* is *normal;* but any deviation from the normal standard in either of these factors makes it possible, and even probable, that permanent dilatation will follow abnormally increased blood-pressure from any cause, especially such as obtains from passing from a lower to a higher altitude. Every day's clinical experience compels the belief that there are conditions of the heart which allow of its sudden dilatation, from which it never recovers, and we are often unable to determine whether such dilatation is due to some tissue change in the cardiac walls, which we can not as yet recognize, or, what seems to me quite probable, to some disturbance in the cardiac innervation. That I may make more intelligible my explanation of the injurious effects of high altitudes on those who give evidence of commencing, or who already have well-marked cardiac insufficiency, I will briefly refer to some points in the chemistry and physics of the atmosphere, and review our present knowledge of the cardiac nerve-supply.

It is a remarkable fact that chemistry detects but little difference in the composition of the atmosphere under the most varying conditions. Whether taken from the crowded thoroughfares of cities, or from the loftiest mountain summit, 100 measures of air contain about 20 parts of oxygen diluted with nearly 80 volumes of nitrogen; whatever else may present itself exists as a foreign admixture, accidental, and in no way affecting the ultimate analysis as far as its essential elements are concerned; even the carbon dioxide variation, whether measured in air collected on the earth's surface, in densely populated districts, or far removed from the earth's surface, as secured by aëronauts, is much smaller than one would think, affecting only the second decimal place. Indeed, its presence might be ignored were it not for the fact that it may afford a measure of volatile organic matter. The atmospheric element, which was long considered insignificant dust, is assuming a new and prominent place; its bacteriological elements are now undergoing rigid scrutiny all over the world. But, thus far, changes in the chemical composition of the atmosphere give us no explanation of the different effects of the higher or lower atmosphere on the cardiac and pulmonary circulation.

If we interrogate the physical properties of the atmosphere for an explanation of the varying effects on the circulation of different alti-

tudes, we find that the amount of pressure is the most important, if not the only essential, element to be considered. While it is a familiar fact that the air decreases in density as we go upward, the ratio of this rarefaction is not so generally understood. At an altitude of 15,000 feet the barometer stands at 15 inches instead of 30, its height at sea-level. The pressure sustained by a man of ordinary size at 30 inches barometric pressure is estimated to be over 30,000 pounds, while at 15 inches barometric pressure it is only 15,000 pounds. This relation between the atmospheric rarefaction and altitude, or, what is equivalent, diminished pressure, is expressed in the law that "the volume of gases is in inverse ratio to the pressure which they support." As we ascend from sea-level the air becomes rarefied or thinned, but it contains just the same proportion of oxygen and nitrogen, whether the analysis is made at sea-level or at the highest altitude ever reached by man. But in the 30 cubic inches of air that we inspire, at the rate of about 18 times a minute, instead of the usual amount of oxygen at an elevation of only 5,000 feet, it has become so reduced that this volume of air contains only 16 parts, instead of the normal 20, virtually at this elevation, the oxygen has become diminished by one fifth, and of necessity either the tidal air or the number of respirations a minute must be increased, in order that the proper supply of oxygen shall be maintained. It seems evident, therefore, that the only physical property of the atmosphere with which we have to do in the solution of our problem is *rarefaction.* We have no concern with particular locations, with atmospheric humidity or dryness, the properties of ozone, or with electrical conditions. Our observations must be confined simply to the effects of atmospheric attenuation.

If we can obtain reliable data from the annals of aërostation of the physiological effects of atmospheric rarefaction at very great altitudes, it will aid in estimating the effects of more moderate rarefaction. The following are the most reliable which I have been able to obtain:

James Glaisher, F. R. S., one of the most experienced, enthusiastic, and authentic aëronauts, gives (London, 1871) a summary of his physiological observations as follows: A normal pulse (70 a minute) at starting, averaged at 10,000 feet 90 a minute, at 20,000 feet 120 a minute, above which other personal distress rendered it impossible to determine the number of pulsations with any degree of positiveness. His lips became blue and his face purple, the veins seeming almost full to rupture. The beat of the heart became dis-

tinctly audible, inspiration became difficult, and the expirations greatly prolonged.

Hartwig (London, 1877) states that at 12,000 feet altitude one feels as if he were in an atmospheric prison, and describes a condition of extreme dyspnœa, cardiac palpitation, facial congestion, epistaxis, and pulmonary hæmorrhages at higher altitudes.

Boügier, on the Cordilleras of Quito, at 15,000 feet altitude, had several hæmorrhages from the lungs.

Humboldt, at 13,000 feet, describes giddiness, nausea, and finally insensibility; his companion had hæmorrhages from the lips, nose, and bronchi. It is impossible, in the highlands of Quito, to drive animals of burden above an altitude of 13,000 feet.

Weber (von Ziemssen's "Encyclopædia") summarizes his recorded results in 29 Alpine tours, with variously constituted individuals, as follows: At from 3,000 to 5,000 feet altitude the pulse and respiration were increased from 10 to 20 a minute, there was more or less dyspnœa, thirst and perspiration were much increased; at 12,000 feet the heart's action in most persons became irregular and extremely feeble, and the respirations difficult.

As I have already indicated, in seeking for the explanations of the effects of high altitudes on the cardiac circulation, the nervous mechanism of the heart must be carefully studied. We are, first, to bear in mind the existence of two *distinct cardiac nervous influences*—one affecting the mechanical rhythm or beat, and a second, which determines the *blood-pressure.* The *rhythmical nervous* phenomena are essentially the result of stimuli having their origin, first, in special centers in the medulla and in the sympathetic system; second, in special centers in the heart; third, in the cardiac muscular fiber. The *blood-pressure* is determined by vaso-motor and vaso-inhibitory centers situated in the medulla, and which are in connection with the general vascular system, the heart receiving both influences from these ganglia by special filaments in the vagus.

The rhythmical medullary influences reach the heart through the pneumogastric, which, taking filamen s from the sympathetic ganglia, distribute both acceleratory and inhibitory fibers to the intrinsic ganglia of the heart. When the heart is removed from an animal just killed, and emptied of blood, it continues for some time to exhibit rhythmical contractions. The rhythmical character of the beat is probably due to the influence of two cardiac ganglia, one accelerator and the other depressor, regulating a third, the cardio-motor center. The motor ganglion causes contraction of the cardiac muscle without

regard to rhythm, while the depressor center holds a check on its action, and the accelerator prevents undue inhibition. If a stimulus is applied to a small, detached piece of cardiac-muscle fiber, in which no nerve-cells can be demonstrated, rhythmical contractions are instituted, which continue for a time after the cessation of the irritation.

Both the cardiac and vaso-inhibitory medullary centers receive *afferent* impulses from the muscular structure immediately under the endocardium, and this mechanism serves as a conservator of the normal relation between cardiac rhythm and general vascular pressure. These afferent influences are exhibited, first, in diminishing the cardiac rhythm by stimulation of the cardio-inhibitory ganglion, and, second, in lowering the pressure of the vascular system generally, consequent on excitation of the vaso-inhibitory center. Under normal conditions, any sudden or unusual cardiac dilatation is immediately checked by this afferent mechanism, the very pressure consequent on the dilatation acting as a stimulant—through the sub-endocardial afferent fibers—to the cardio-inhibitory center, diminishing the rhythm, and to the vaso-inhibitory center, lowering the blood-pressure.

I regard this afferent mechanism as the most important of the factors contributing to the preservation of the normal relations between the heart—its pressure and rhythm—and the respiratory function, and, in order to its maintenance, the following conditions must be fulfilled: 1. The nutrition of the cardiac walls must be unimpaired. 2. The coronary arteries must supply the proper amount of oxygenated blood. 3. The medullary centers must be in a condition to respond to the afferent stimuli. Physiological experiments demonstrate that the *tissues* of the body are primarily affected by atmospheric rarefaction. In the ordinary course of ascent from sea-level, a point is finally reached where the normal balance between demand and supply is disturbed, the measure of tidal air becomes insufficient on account of its rarefaction, the tissues call upon the heart for an increased supply of oxygenated blood, and the response is made by increased rapidity of the cardiac rhythm. This fails to satisfy the demand, as the heart depends upon the lungs for an adequate supply of arterialized blood, and they consequently are called into increased action. Whether the ultimate results are due to an increase in the frequency of the respiratory rhythm, or to an increase in the tidal volume, does not alter the conditions so far as our present purpose is concerned. In order to produce tension on the cardiac muscle, a very high altitude is not required, but the resulting phenomena becomes more apparent the greater the atmospheric attenua-

tion. It is noticeable that the aëronauts and travelers, already referred to, after reaching certain altitudes, almost invariably describe a series of symptoms the result of an increased amount of venous blood, especially in the vessels of the head and face. The subject's lips are blue, the skin is purple, he becomes nauseated, epistaxis ensues, and he describes a distressing cardiac palpitation. The lungs are no longer able to obtain the necessary oxygen from the attenuated air, and the blood contains an amount of carbon dioxide approaching that of asphyxia. Ordinarily, the increased intra-ventricular pressure will send stimuli through the afferent cardiac nerves to the cardio- and vaso-inhibitory centers, and this pressure will be regulated and relieved; but in the conditions producing the effects which I have just enumerated, for a cause which we have yet to seek, this relief is not established.

It has been stated that, as a result of atmospheric rarefaction, the chest capacity is increased, the pressure on the pulmonary vessels is relieved, the muscles of respiration are strengthened, and the amount of residual air is diminished. It is difficult to understand how diminution of residual air in the lungs can follow increased chest capacity. If the pressure on the pulmonary vessels is relieved by the atmospheric rarefaction, the pressure on the peripheral vessels generally is diminished as well, so that, without corresponding increase of cardiac action, there would be no gain to the pulmonary tissue. This increased heart-action must unquestionably result, but, while increased action in skeletal muscles may and does promote their development, exaggerated functioning of cardiac muscular tissue results in changes which ultimately defeat its own efforts. If, in conditions of an unusual and continued demand upon the circulatory apparatus, the lungs were finally able, by increased development or functioning, to satisfy the requirements, the increased action of the heart would necessarily subside, and it would resume its normal rhythm. But what evidence is there that this strain is removed in such cases as I have enumerated as long as the individual remains in a highly rarefied atmosphere? The respiratory and cardiac organs belonging to the individuals with whose welfare we are now concerned are more or less impaired. If it were sufficient for them to breathe this rarefied atmosphere with the same frequency, and in the same amount as would suffice for normal individuals breathing at sea-level, then were the conditions changed indeed; but in breathing rarefied air they are required to do more work with their lungs than would suffice under the conditions of ordinary pressure, so the strain

is continued. While, in consequence of the remarkable adaptation of life to varying conditions of environment, an approximation to success is attained by the respiratory organs, the demand of the tissues is always in advance of the supply, and the resultant increased heart-power defeats itself.

The two important factors which lead to permanent cardiac insufficiency are, first, the condition of pulmonary distension consequent upon atmospheric rarefactions, and, second, the resultant condition of the circulating blood; in the first, the terminations of the vagus are excited by the distension of the lungs. By the excitation of these afferent fibers the cardiac as well as the inspiratory ganglia of the medulla are paralyzed or weakened, the inhibitory control being lost, the diastolic intervals shortened, and the rhythm increased, but the amount of work accomplished is not proportionate to the display of cardiac energy. The change in the blood, which acts as an important, and ultimately the principal, factor in producing cardiac insufficiency, is its deficiency in oxygen. The vaso-motor centers of the medulla, influenced by want of oxygen in its blood-supply, excite a general contraction of the arterioles of the body, filling the venous system and affording a large heart-supply, while the cardiac pressure rapidly rises as the peripheral resistance is increased. Ordinarily, under such contractions, the heart would relieve itself, as has been previously intimated, by excitation of the cardio- and vaso-inhibitory centers, but these centers are held in abeyance by the condition of the blood circulating in the medulla. This condition of increase in the intra-cardial pressure can not continue, for the blood in the coronary arteries is poorly adapted to the needs of the organ, by its want of oxygen, to say nothing of its load of carbon dioxide, and, sooner or later, the heart passes into a state of diastolic relaxation which is the primary step to a condition of permanent ventricular dilatation. We have already seen that the contact of the circulatory blood with the endocardial surfaces may act as an important factor in the maintenance of the normal rhythm, through the influences exerted directly on the afferent cardiac filaments. It is not improbable that the blood distributed by the coronary arteries, heavily laden with carbon dioxide, also acts as a disturbing factor on the normal action of the heart through this same afferent mechanism. If this explanation of the effects of high altitudes upon the cardiac circulation be accepted, the risks which one, with even slight cardiac insufficiency, runs by passing rapidly from a low to a high altitude are certainly very great, and, if the cardiac insufficiency is extensive,

such changes in altitude become immediately dangerous, and it is to be remembered that cardiac insufficiency is not confined alone to those who give the evidences of valvular lesions with cardiac hypertrophy or dilatation, although it exists to a greater or less degree in all such cases, but it is often present in those who give no evidence of such lesions. The ætiology of cardiac dilatation is a subject which, at the present time, is interesting, more than ever before, those who are studying cardiac disease. I have been accustomed to include all the recognized causes of such dilatation under the general head of those conditions which give rise to increased blood-pressure within the heart; and I am confident that the effects of such pressure will vary greatly, whether it is made during the contraction or relaxation of the cardiac muscle. Forcible dilatation of the cardiac wall, when it is in a flaccid state, is far more likely to produce dilatation than forcible dilatation when the wall is contracted. Experiment has demonstrated that, during their contraction, the walls of the heart are able to withstand high internal pressure without their cavities being dilated. If, then, as I think I have conclusively shown, when cardiac enervation exists, from any cause, the excessive relaxation of the ventricular muscle which attends it leads to over-distension of the ventricular cavities, and this may result in permanent dilatation depending in a greater or less degree on the condition of the cardiac walls; may not this be the explanation of those sudden ventricular dilatations which I have reported, some of which must be classed under the head of what writers are calling dilatation of the ventricles without any discoverable cause? The important clinical question always to be decided is in regard to the integrity both of the cardiac muscle and of its innervation.

In endeavoring to determine the muscular power of the heart in cases of cardiac disease, it is important to study, from a clinical standpoint, the factors which contribute to the first sound of the heart. While physiologists are inclined to doubt the existence of a muscular element on theoretical grounds, I am satisfied that, synchronously with the beginning of the ventricular systole, an element of cardiac resonance is projected that can not be referred either to the apex beat, the friction of the blood current, or to the closure of the auriculo-ventricular valves. When, with a stethoscope, one listens to the heart of an animal just killed, emptied of its blood, its valves cut, a sound is heard, as I have repeatedly observed during Dr. Miller's experiments after he had eliminated every possible chance of a friction element by placing the heart on a bag filled with air, which

has seemed to me to be produced by the muscular contraction of the ventricular walls. Whether we understand everything of cardiac muscular contraction as yet is questionable, and we are obliged to hear the sound without knowing just how it is produced. Clinically, I know that an impairment of the integrity of the muscular structure of the heart-walls results in just such a modification of the first sound as one would expect who had listened to the organ under the conditions just mentioned. The absence of this element in the first sound has come to indicate to me a failure in the integrity of the heart-power which would lead me to caution such a one against passing rapidly from a low to a high altitude. My clinical experience has also convinced me that it is unsafe for one to make such changes whose cardiac rhythm is greatly disturbed by nervous excitement or by rapidly ascending a long flight of stairs. It may justly be said that the number of persons who every year are passing from low to high altitudes without inconvenience is so large that the dangers to which I have referred are insignificant. To one, however, who is carefully watching the effects of climate and altitude on a considerable number of persons with pulmonary and cardiac disease, these effects do not seem insignificant. If I interest others in the study of this subject, I shall have accomplished the object of this paper.

Paper.

PRELIMINARY ACCOUNT OF EXPERIMENTS IN REGARD TO THE CIRCULATORY AND RESPIRATORY CHANGES OBSERVED IN ANIMALS PLACED IN THE PNEUMATIC CABINET.

By H. N. MARTIN, F. R. S.,
and FRANK DONALDSON, Jr., M. D.

THE great objection to the use of the pneumatic cabinet has been, beyond doubt, that we had no knowledge of the physiological effect of rarefied and compressed air applied under these conditions on the respiration and circulation; and, indeed, I found myself so timid and embarrassed in its every-day use that I determined to submit no person further to treatment by pneumatic differentiation until I had got at its physiology. I was, therefore, very glad to take advantage of Professor Martin's suggestion that we should conduct a series of experiments upon animals placed in the pneumatic cabinet. The results of these experiments are given very briefly below. A more detailed account of them, with illustrations showing the changes

in blood-pressure, pulse, and respiration actually observed, will appear hereafter. Our experiments have been made on rabbits, and have so far had reference only to changes in arterial pressure, in pulse-rate, in respiratory rhythm, and in the extent of respiratory movements when the air within the cabinet is rarefied or condensed.

The rabbits were chloralized, and a glass tube was placed in the trachea. From the glass tube a rubber tube led to a T-piece. From one limb of the T-piece a tube led to a Marey's tambour, which recorded on the kymograph paper the rate and extent of the breathing movements. To the other limb a tube was attached through which the animal inspired and expired. In some cases this tube opened outside the cabinet and the animal took air into its lungs under the normal atmospheric pressure. In other cases the breathing-tube opened inside the cabinet, and the animal breathed rarefied or condensed air, as the case might be.

A cannula placed in the femoral artery recorded on the kymograph paper the arterial pressure and pulse-rate. Another manometer, placed in communication with the interior of the cabinet, recorded the variations of atmospheric pressure within it. A fourth pen was connected with the clock, and recorded seconds of time on the paper. We are enabled to state our results as follows:

I.—When the animal is breathing air from outside the cabinet, rarefaction of air within the cabinet causes a marked fall of general arterial pressure, but has no influence on the pulse-rate. The fall of pressure lasts a short time only (ten to twenty seconds), and is followed often by a temporary rise above the normal.

II.—This fall of systemic arterial pressure depends on two factors: greater flow of blood to the skin when the air around the animal is rarefied, and greater accumulation of blood in the lungs when they are distended.

III.—Of these two factors, accumulation of blood in the lungs is the more effective; for, if the animal breathes air from the cabinet and not from outside, rarefaction of air within the cabinet (in this case accompanied by no special expansion of the *thorax*) has but a trivial effect in lowering arterial pressure.

IV.—When the animal is breathing external air, rarefaction of the air within the cabinet usually has no effect upon the respiratory rate or the extent of individual respiratory acts, unless the fall of blood-pressure is considerable. If it is considerable, symptoms of anæmia of the *medulla oblongata* are seen. In most cases there is more forcible dyspnœic breathing; in some there are dyspnœic con-

vulsions similar to those which occur when an animal is bled to death, and due to the same cause, viz., deficient blood-flow to the respiratory center.

V.—The rapid recovery of general arterial pressure, while the animal is still in a rarefied atmosphere but breathing external air, is probably due to excitation of the vaso-motor center, which, as is well known, is excited whenever its blood-supply is defective.

VI.—The brain, inclosed in a rigid box, which is practically unaffected by variations in atmospheric pressure, has its circulation more disturbed in the pneumatic cabinet than any other organ except the lungs.

VII.—Compression of the air within the cabinet, while the lungs are in communication with the exterior air, causes a considerable but transient rise of blood-pressure. This is probably mainly due to the forcing of blood from the cutaneous vessels; but we have not yet had opportunity to thoroughly investigate this point.

VIII.—Compression of air within the cabinet, while the lungs are in communication with the exterior air, slows the pulse as the arterial pressure rises. This is probably due to excitation, by increased intracranial blood-pressure, of the cardio-inhibitory center; but further experiments are necessary before this can be positively stated.

IX.—In certain cases, when the air within the cabinet is rarefied and the animal is breathing external air, the respiratory movements cease altogether for several seconds. As to the cause of this physiological "apnœa" we are not yet ready to form an opinion. It may be due to the extra accumulation of air in the alveoli of the lungs, or to distension of the lungs exciting those fibers of the pneumogastric which tend to check inspiration.

Such, in brief, being the physiological effect of rarefied and compressed air as applied in the Ketchum cabinet, how should this knowledge affect the practical use of this apparatus? It having been found that even very great rarefaction of the air in the cabinet produces but slight effect on the circulation, provided the animal is breathing the air within the cabinet, I conclude:

1. That rarefaction of the air when the person first enters the cabinet (as directed by Mr. Ketchum), in order that the residual air may expand and so drive out any plugs of mucus in the lungs, may be done without danger to the individual. In view of the great and sudden fall of arterial pressure when the animal is breathing outside air and the air within is rarefied, I conclude:

2. That the air in the cabinet should never be suddenly rarefied,

and that the motion of exhaust should invariably be slowly made, and the amount of rarefaction small, particularly at the first treatments. This sudden fall of arterial pressure depending as it does upon an increased blood-flow to the skin and an accumulation of blood in the distended veins and lung alveoli, I conclude:

3. That, before deciding a person to be a proper subject for treatment by pneumatic differentiation, *thorough examination* should be made of the *heart;* and that no person found to have pronounced insufficiency or stenosis of the mitral valve or the slightest tricuspid regurgitation should, under any condition, be placed in the pneumatic cabinet; for it is plain that rarefaction of the air would be most dangerous in such cases. The fall of arterial pressure would seem to depend chiefly upon the accumulation of blood in the lungs, for, if the animal breathes air from the cabinet and not from outside, rarefaction of air within the cabinet has but a trivial effect upon arterial pressure. From this fact I conclude:

4. That the liability to pulmonary hæmorrhage is very slight, though greater perhaps than Dr. Williams has supposed. It having been proved that compression of the air within the cabinet while the animal breathes external air causes a considerable rise in arterial pressure, and slows the pulse from the increase of intra-cranial blood-pressure, I conclude:

5. That old persons, with possibly atheromatous arteries, are not, generally speaking, proper subjects for the pneumatic chamber, especially where their trouble is emphysema or asthma, and compression of the air within the cabinet is made use of in order to assist expiration.

Again, in view of the sudden and pronounced fall in arterial pressure following rarefaction, and of the considerable though transient rise of the same following compression of the air in the cabinet, I conclude that the method of differentiation should be practiced with much care and discrimination in all cases, and that the actual movements of exhaust and compression should be made always very slowly and gently.

Finally, the Ketchum cabinet should be in the hands of careful auscultators only, for in those of the inexperienced or careless great harm may be done.

Paper.

A CLINICAL REPORT OF CASES TREATED BY PNEUMATIC DIFFERENTIATION.

By HERBERT F. WILLIAMS, M. D.

IT is with a full appreciation of the danger of becoming wearisome that I feel compelled to give somewhat in detail my further clinical experience with the pneumatic cabinet. Such suggestions as I shall deem proper will appear with the report of each case, the history and study of which may be said to have prompted them. For the establishment of any new device or procedure in the healing art, practical investigators are willing to accept the drudgery of compiling clinical results, for in this manner only can practical conclusions be reached which must establish the utility of the matter in question. It is with satisfaction that I have received from prominent men who have had the opportunity to examine many of the cases that form the basis of my first report assurances that my diagnoses were correct and my conclusions honest and not overdrawn.

In my original report in the "Medical Record" for January 17, 1885, results were recorded which have been termed "brilliant" by some enthusiastic believers in the differential process. Some careful men have feared that the application to five advanced cases of phthisis of the term "recovery" might have created a feeling of incredulity concerning both the description and the describer, and endangered or delayed the development of this process. Had the continued application of this process by myself and others failed to corroborate those results, I feel that the uncommon precaution of having my diagnoses and results in those cases confirmed by competent observers, together with the moderate statements that are found in the closing paragraphs, would have saved me from the righteous oblivion that is meted out to willful misrepresentation or unpardonable incompetency and rashness. There seems to be no common understanding or agreement as to what constitutes a recovery in advanced phthisis, but the necessity for such a term sinks into insignificance when objective results are fully recorded. My determination to adopt these measures of confirmation was greatly strengthened by the reading of a paper by Dr. Sidney A. Fox, of Brooklyn, before the Kings County Medical Society, entitled "A History of Sixty-nine Cases treated by Pneumatic Differentiation," where in many

instances I had the opportunity to examine his cases before and after treatment.

In Case I of my first report (acute catarrhal phthisis, stage of softening) the patient has been in good health up to February 1st of this year; weight 126 pounds. The last of January she attended a funeral on a cold and blustering day, and during the journey to the place of interment kept her feet warm by means of a heated foot-stove; was sufficiently imprudent to leave the carriage and stand by the grave during the recital of the burial service. A violent cold was contracted for which she did not seek relief until the latter part of February, and then on account of a hæmorrhage which occurred in the night, induced by great violence in coughing.

The inheritance of phthisis in some is an inheritance of carelessness and indifference. Though this patient had a phthisical mother, she is the personification of carelessness, whether inherited or acquired. She again commenced treatment March 15th; her weight had declined to 115 pounds; high evening fever, constant cough, and profuse expectoration which contained bacilli. Her physical signs gave evidence of acute phthisical degeneration. She took eight treatments, but the journey from her home in Brooklyn to my office in New York seemed to exhaust her, in consequence of which she was placed under the charge of Dr. Fox and Dr. Brown, of Brooklyn, from whom she is now taking treatment; but her progress is slow, and there are grave doubts of arresting the phthisical process.

On September 5, 1883, this young lady was considered to be in a hopeless condition by five careful physicians who then examined her. At this date her treatment by pneumatic differentiation began, and as a result she has had over two years of immunity.

Case II.—(Phthisis, third stage.) Patient remains in good health; has had one or two colds this winter and coughed a little in consequence; has received no further treatment.

Case IV.—(Abscess of left lung, producing extreme exhaustion, with primary changes taking place in right lung.) Patient in the same condition as last reported; well, with exception of slight fistula in side.

Case V.—(Acute bronchial catarrh with sub-epithelial abscess and peri-bronchial inflammation.) Patient was at last accounts driving an ice-cart about the city. He has had one severe hæmorrhage since last report, from which he fully recovered without serious lung change taking place.

The seven patients with primary infiltration are well with the exception of two. Mr. F., whose family history is phthisical, remained

well until June, 1885, a period of about eighteen months, when he was seized with a severe hæmorrhage after prolonged exposure to the hot baths of Salt Lake City. He returned to me for treatment in October, 1885, remaining a month, and is now living in Rondout in good condition. Mr. M., the other, whose case was No. 3 of my original report, has been depressed by business disappointment and increased domestic responsibilities. He has taken seasons of pneumatic treatment under the care of Dr. De Watteville, of New York, who reports him at present in an improved condition, though he notes a steady decline from year to year. From June 12, 1885, up to the present time, I have treated forty-five additional cases of pulmonary disease by this process.

Of these cases I will give as concise a report as possible consistently with the particular phase that each represents, and the hints for treatment that each suggests.

Case I.—M. B., bachelor, gentleman, a high liver, aged sixty-one; best weight 140, present weight 105; expansion one inch; no history of phthisis; in delicate health for two years. Pain in left scapular region; slight exertion produces great distress for breath. Has traveled extensively in search of health. Expectorates profusely and coughs incessantly.

Physical examination shows respiratory movement in left side restricted; emaciated, flatness of clavicular spaces; percussion shows high pitch in left side, most marked in upper portions, but resonance defective throughout. Auscultation shows feeble respiratory sounds on right side. Left side broncho-vesicular, cog-wheel; prolonged expiration; deep-seated râles.

Received nine treatments (iodine in spray), covering a period of one month, at the end of which time his expansion had increased to one inch and five eighths; cough relieved, expectoration easy and less; walks about with comfort; weight increased. Started for Denver, where in three weeks his weight had increased to 120 pounds. This case shows the benefit that follows a thorough expansion and the more marked improvement that follows climatic influence in consequence of increased respiratory power. This patient is in a fair condition to-day, though incapable of recovery.

Case II.—(Referred by Professor A. L. Loomis.) Mr. L., aged forty-four, married; best weight 125, present weight 110; family history clear; dyspeptic for several years; asthma for twelve years, slight at first but increasing in severity every fall, when he has had attacks of acute bronchitis. One year ago had pneumonia with slow and imperfect resolution; can not lie down at night, sleeps poorly, no appetite.

Physical examination shows increased resonance in both lungs, with exception of scapular region of right, where it extends to the axillary

region; there is high-pitched percussion; increased area of cardiac dullness. On auscultation, the respiratory sounds are not so strong as the percussion note would indicate. The inspiratory act of right lung is attended with fine crepitation, which is superficial. There are mucous and dry râles interspersed through both lungs. Treatment began June 22d and continued at first tri-weekly, then once a week. He now appears occasionally; spent the fall and winter in complete comfort; his asthma is greatly relieved; his crepitation gone; a spray of chloride of ammonium with tincture of stramonium was generally used; his weight to-day is 118¼, within 5¾ pounds of normal; has taken in all forty-seven applications with an average rarefaction of $\frac{6}{10}$ inch. At times he is simply allowed to inspire, at others to complete the act into the outside atmosphere.

Case III.—(Referred by Professor Henry I. Bowditch, of Boston.) *June 23, 1885.*—Mrs. C., aged forty, married; grandfather died of quick consumption; best weight 115, present 91. Evening temperature 100°; expansion 1¼ inch; in good health until two years ago, when she had pneumonia from which she has never recovered. She has a hacking cough which prevents continued conversation; since January slight exertion provokes coughing; she can not go up or down stairs with ease; complains of great pain in left lung; expectorating freely; estimates quantity at one half cupful daily; appetite poor; menstruation scant.

Physical examination shows emaciation and extremely feeble respiratory movements. The percussion note is normal in right lung; the left shows dullness in subclavicular region near clavicle; the note is of varying character in different regions of this lung, but there is a general absence of normal resonance. Auscultation shows a fair vesicular murmur in right lung, but the left is irregularly broken down, gurgles being easily demonstrated in the clavicular space; there are no respiratory sounds in the lower lobe. This patient took daily treatment covering a period of five weeks, taking in all thirty-two treatments; rarefaction increased from three tenths to eight tenths, and occupying from fifteen to twenty minutes daily. Iodine and mercuric bichloride were used in spray; marked amelioration in cough, and diminished expectoration; increased ability in walking; reads aloud with comfort; expansion increased one half inch; weight, ninety-six pounds. Physical examination shows increased circulation of air in the left lung, including the lower lobe, though the upper portion remains the same as before, with the exception of diminished quantity of gurgles; this patient was last seen since January 1, 1886, when she professed a continued improvement, though no examination was made.

Case IV.—Mr. P. This gentleman I knew personally for ten years, having been his family attendant during this time. On July 15th he appeared at my office and complained of symptoms which pointed to an enteric disturbance, which the warm season for several years has produced. For three years in succession he has suffered from dysenteric

symptoms that have confined him to bed from two to three weeks. To forestall this, I instructed him to go home and to bed, where I attended him for several days. He complained of little pain in his left side; his temperature was 102° every afternoon, and resisted my best efforts at reduction. We had succeeded in preventing his diarrhœal trouble, but his continued fever and growing weakness demanded a further examination, which was made July 25th. He never complained of a cough, and there was literally nothing but the slight pain in his left side to point to the disclosures of his left lung, which I found to give evidence of consolidation. Regarding this as suspicious of a low grade of pneumonia, or rapid and general tubercular infiltration, I made arrangements to give him the benefit of the pneumatic treatment, which were completed July 30th, at which time his condition was as follows: Mr. P., aged forty-two, married, machinist, best weight 150, present 136, temperature 101°, expansion one inch—all on right side. Father and two sisters died of phthisis; pale, anæmic, and emaciated; respiratory movement of left side confined to a heaving movement of scapular region; no movement in the lower left thorax; the percussion note showed good resonance in the superior portion of the left lung, extending to the third rib; the mammary portion and posteriorly, from the spine of the scapula, it was of high pitch and short duration; right side showed increased resonance; auscultation gives normal vesicular murmur in superior portion of the left lung, front and back; breathing bronchial over lower portion of the scapular region. The sounds are indistinct below this point.

He was submitted to treatment, using one-to-five hundred mercuric bichloride in spray, and at his first application breathed easily against six tenths rarefaction, the major part of his breathing being done with his right lung. Auscultation showed no evidence of deeper penetration of air, and no diminution in the bronchial breathing. Auscultation while breathing in the cabinet revealed a perceptible change in the character of the sounds, which were, at least, broncho-vesicular. The following day examination immediately before treatment revealed bronchia, breathing. Immediately after, the breathing for one or two respirations was broncho-vesicular, but rapidly changed to bronchial during auscultation. It should not have required this demonstration to clear up my original diagnosis; the left thorax was demonstrated to be at least half full of pleuritic effusion. The increased expansion of the lung by the normal air caused an even distribution of the effused fluid in the thorax, and the respiration became vesicular. Upon leaving the cabinet, the lung was quickly pressed up against the superior thorax, partly by its own contractility, but principally by the gravitation of the effused fluid. Now the respiration became bronchial. Ninety-six ounces of serum were withdrawn by aspiration, requiring three operations at intervals of forty-eight hours.

In two weeks from this time patient again commenced treatment. After ten applications there was an even expansion of the lungs. There still remained a deficient percussion note in the lower left axillary region.

In October he resumed his work, having gained nearly his normal weight and strength. On December 25th he was seized with a chill while sitting near an open door. On December 30th a general pleurisy of the right lung was detected, for which he was actively treated. This attack was characterized by violent symptoms, and resisted every endeavor to control fever and conserve his strength. Forty-grain doses of quinine would reduce his temperature from 105° to normal, but only temporarily. January 28, 1886, his respiratory sounds became coarse and harsh; cough had never been a prominent symptom, and he had scarcely any expectoration. Bacilli were now for the first time detected; he was made to abandon all hope of being able to resume cabinet treatment. February 5th his condition was hopeless; but, as a last resort, ten minims of cultivating fluid, containing the sixth and seventh generations of *Bacterium termo*, were subcutaneously injected, the injection being repeated twice at intervals of six hours. A diffused redness about the points of puncture was the only disturbance noticeable.

This procedure was justified by the absolutely hopeless condition of the patient, the certainty of an autopsy, and the hope that the latter might yield some further light upon the questions of bacteria therapy now exciting interest in foreign biological laboratories.

On February 8th he died. On the 9th an autopsy was made by Dr. A. H. P. Leuf. The right pleura was covered with plastic lymph, with recent adhesions. The superior lobe was infiltrated with miliary tubercles; the left lung was attached at its lower border by old adhesions and a thickened pleural sac containing about two ounces of fluid. The left apex contained tubercles, but less profuse than the right. No effusion in right thorax. Microscopic examination of lung shows enormous quantities of *B. termo*, but no apparent diminution of the specific bacilli. This case is given in detail for two reasons: First, it demonstrates the necessity of not allowing our preconceived conclusions to persist when careful physical exploration discloses their fallacy. Second, a pleurisy with such a history points to a tubercular dyscrasia, which a prompt and thorough disinfection arrested. This is proved by the comparative freedom from tubercular infiltration of the left lung, which five months previous had been the seat of an inflammatory action similar to the subsequent attack on the right lung, where efficient disinfection could not be employed by reason of patient's inability to get to the cabinet.

Case V.—(Referred by Dr. Woodside, of Williamstown, Mass.) Miss A. D., aged twenty-four, unmarried, best weight 117, present 107, expansion two inches, immediate family history clear, paternal uncles and aunts died in early life. Sick since August, 1884; early cough and hoarseness: hemorrhage in November of same year, which was not controlled for a week. Sent South in January, 1885; remained four months, with improvement, which was maintained up to the latter part of August, when she caught a fresh cold, which has aggravated her symptoms. To-day, September, 1885, her condition is as follows: Appetite poor; coughing, especially at

night and morning; expectorating yellow matter; shortness of breath; pale and anæmic; chest thin and emaciated; lack of normal motion left side; fremitus most marked right side. Percussion note high pitch; in outer clavicular angle of left side, over right apex, front and back, the note is high pitched. On auscultation, both lungs in front the respiratory sounds are harsh; fine crepitation accompanies the first half of the inspiratory act; outer right pectoral region there is a prolonged expiratory murmur on both sides; left side scapular region, respiration is broncho-vesicular, coughing producing fine crepitation in right clavicular space.

This patient received thirteen treatments, with an average rarefaction of six tenths of an inch, using the mercuric bichloride in spray alternately with a solution of iodine. She was allowed to reside in Bloomfield, N. J., taking the train to New York, a distance of fourteen miles. There was no improvement, excepting in expansion and a slight diminution in expectoration; her weight decreased two pounds, and, under the above circumstances, further treatment was considered of doubtful value. On her return to Williamstown, Dr. Woodside noted a deeper and freer penetration of air. This case is reported to show the necessity of making proper arrangements as to access to the cabinet before commencing treatment.

Case VI.—Mrs. B., aged thirty-five, best weight 135, present 122; expansion one inch and three quarters; one brother died of hasty consumption, aged thirty-five; trouble began in spring of 1885, with cough, rapid emaciation, and night-sweats; was sent to the Catskills by her physician in June; remained eight weeks. The month of September was spent in Morristown, N. J. Physical examination October 25, 1885. Sallow, anæmic, evident emaciation, feeble respiratory movements; can not go up or down stairs or walk fast; fever at night; expectoration profuse, but heavy and difficult to raise; cough very troublesome; menses scant and irregular. Percussion, right side, normal; left, there is cracked-pot resonance, in middle of infra-clavicular space. Auscultation, right side, sounds are harsh, cog-wheel, with prolonged expiratory murmur; left, cavernous breathing in middle apex, with gurgles; the excavation extends to third intercostal space. This case has been under treatment up to March 31st of this year, taking in all forty applications with an average rarefaction of eight tenths of an inch, with sittings of from fifteen to twenty minutes; the treatment was sometimes supplemented by the method of artificial respiration (*i. e.*, placing the valves at D and vibrating the air from plus to minus the weight of the normal atmosphere). The mercuric bichloride was used for the first fourteen applications, afterward tr. iodine, five-per-cent. solution; her weight has increased to 133 pounds—within two of her best previous weight; no retraction has taken place in the left side; she has periods of coughing and expectoration, and

small gurgles are still detected in cavity, which is reduced in size and becoming irregular.

It is too early to predict a recovery in this case. Yet, in the light of past experience, continued treatment should, I believe, produce ultimate quiescence of her symptoms. In justice to the cabinet, it may be noted that this patient has taken no other treatment except occasional prescriptions for relief of incidental symptoms not directly pulmonary.

Case VII.—In this case I will give an exact transcript of my examination notes. October 7th, Mrs. A. G. F., married, house-keeper, aged thirty-two, mother of three children. Best weight 138 pounds, present weight 122½; pulse 112; temperature, 2.30 P. M., 101°, expansion one inch. Family history: Mother died of uterine trouble; father living. Personal history: Two years ago commenced with hacking cough; night-sweats; has been to many physicians, Dr. Leaming succeeding in abating the symptoms; last summer, after taking cold and attention to sick child, the trouble started afresh. At the present time has pain in left side, coughing, "raising phlegm" with difficulty; night-sweats, chilly toward evening; can not go up stairs: no appetite and dyspeptic; constipated; menses irregular and scant; phlegm greenish; cough so violent that vomiting is produced. Inspection shows large full eye, with blue sclerotics; anæmic; flesh flabby; emaciated, with clavicular depressions; tongue red; respiration 26 per minute, feeble respiratory movements. Palpation apparently normal on right side; left absent.

Percussion.—Lack of normal resonance in both supra-clavicular spaces. There seems to be no abnormality excepting in the subscapular, axillary, and submammary regions of the left side; here the note is high pitched; the point of greatest flatness is at the junction of the axillary and subscapular regions.

Auscultation.—The inspiratory murmur in both infra-clavicular spaces is harsh and wavy. Deep inspiration produces annoying cough; in the supra-clavicular spaces there is broncho-vesicular respiration; there are moist râles on the left side in the subscapular and axillary regions. Treatment began October 7, 1885, and continued until December 19th, taking nineteen applications. Bichloride of mercury was alternated with iodine. From six to eight tenths rarefaction was maintained for fifteen minutes at each sitting; for the last six applications artificial respiration was used. On December 19th every symptom had abated. All her functions normal; weight 128 pounds. March 11, 1886, has caught a fresh cold and returns for treatment. Her improvement since December 19th has been phenomenal; she now weighs 154½ pounds; has remained in the city all winter in perfect health; thinks herself in the third month of pregnancy.

On April 28, 1886, I called on Dr. Leaming with reference to this patient. He authorizes the statement that, when he last examined her in July, 1885, he found an extensive inter-pleural plastic exudate of the left lung, and that the diseased process had extended into the lung tissue.

Case VIII.—Miss M., aged twenty-five, unmarried: best weight 120; present 101; father died of phthisis and Bright's disease, aged fifty-eight; mother, of phthisis, aged thirty-nine. Has been sick two years with the usual symptoms of progressive phthisis; has been taking cod-liver oil, hypophosphites, and general tonic treatment. She is now coughing and expectorating, has evening fever, emaciation, marked clavicular and intercostal depressions. Percussion shows high-pitched note in outer subclavicular space of right lung; over left apex, extending to the second intercostal space, the note is high pitched. Auscultation shows bronchovesicular respiration in the right apex. Left apex near sternum gives irregular respiration with gurgles and surrounding bronchial respiration. Microscopic examination shows bacilli. Treatment began October 31, 1885, and has continued up to April 19, 1886, coming every day for first ten applications, then thrice weekly. At present once a week. The stronger antiseptics were used. She has maintained her weight during the winter, and now weighs 103 pounds. The auscultatory sounds show sonorous râles and rhonchi, but the former evidence of small cavities is wanting. Her sputum shows absence of bacilli for the last two examinations, covering a period of four weeks. Enormous quantities of bacteria that can not be distinguished from *B. termo* are found.

Case IX.—(Referred to me by Dr. Mary Putnam Jacobi, November 6, 1885.) G. P. S., aged thirty-nine; one sister and one paternal aunt died of phthisis; has been under Dr. Jacobi's care for some time, using, with other treatment, the compressed-air method of Waldenburg. The necessity for this was a severe congestion of the right lung in February, 1885, which confined patient to the house for three weeks. Dr. Jacobi's notes of the physical examination are as follows:

"Right lung superiorly, relative percussion dullness from clavicle to third rib, ordinary respiration feeble; in forced respiration, inspiration is suddenly checked at close, then weak sound during expiration, not like tubular breathing, but suggesting the forced expansion of an adherent pleura. Posteriorly, supraspinous space, inner half, ordinary respiration gives wavy inspiration; forced respiration gives soft tubular expiration. Outer half, soft pleural crackling, which extends down to outer half of the scapular region, encroaching a little on the axillary space, heard distinctly at ordinary respiration, more at forced respiration; heart is normal, though pulse easily 87. There is sugar intermittently in the urine; patient was a week ago in the midst of an acute bronchial catarrh, from which undoubtedly your treatment should give relief, whatever may be done for the chronic pleurisy." The treatment was begun November

10th, and was continued uninterruptedly tri-weekly until December 10th; rarefaction was the force employed, and six to eight tenths the amount maintained for fifteen to twenty minutes. Tr. iodine, five-per-cent. solution, diluted with extract of pine needles, and glycerin sprayed.

My notes of this case show a rapid improvement of the symptoms, which are further confirmed by a note from Dr. Jacobi dated December 7, 1885: "I find the patient much improved. The bronchitic attacks really seem entirely cured, and more air enters the upper part of the lungs under the clavicle. I still find the traces of the chronic pleurisy, and indeed should not expect that to disappear." On February 2, 1885, Dr. Jacobi writes as follows: "The patient you treated for me, I think, in November, 1885, and who rapidly improved under the use of the cabinet and spray, seems now entirely well. Has been living in the country; has used the Waldenburg at home to continue the effect of compressed air, and a respirator in the city to avoid the irritation of the city dust; has had no cough since, and I find to-day that the pleural crackling has about disappeared. Has resolved, in case of a fresh attack of either bronchitis or pleurisy, to return to you at once, and this I have advised."

Case X.—(Case referred by Dr. Fowler, of New York, Dr. Loomis concurring.) Mr. W. S., clerk, aged twenty-eight; best weight 150, present 124¾; pulse 110, temperature 101°, expansion one inch. Early mortality in seven paternal and five maternal aunts and uncles, but no satisfactory evidence of phthisis. Three years since was ill with pleurisy, left lung; one year ago pleurisy right lung.

March 20, 1885.—Had croupous pneumonia, right lung; this has never resolved, now coughing and raising; hectic; no appetite, extremely weak, progressive emaciation, respiratory movement extremely feeble, nil on right side, fremitus increased right side. Percussion over middle and lower lobe of right lung extremely high-pitched (flat); careful percussion in clavicular spaces fails to give a full normal note. Auscultation shows on right side a loss of vesicular element in clavicular spaces; respiratory acts are short, and, the lower down we listen, the less distinct they become. The inspiration is faintly bronchial and attended with fine crepitation over the lower posterior border and axillary space; left shows sibilant râles in upper lobe.

Treatment began November 12, 1885, with two tenths rarefaction, but, on account of the great weakness of the patient, it became necessary to use the artificial respiration; by the 18th he was able to maintain a rarefaction of six tenths, inhaling a solution of ammonium chloride, glycerin, and carbolic acid; afterward the tincture of iodine and pine-needle mixture was used; he averaged four to five treatments a week, and up to December 30th had taken twenty-five applications; his examination now shows a freer expansion of his right lung, and the bronchial respiration had become more pronounced; his expansion had increased to two inches and a half, and there was some diminution in the number of moist râles in the right lung; his weight declined two pounds, but he was stronger

and took a walk of three quarters of a mile on January 1, 1886; his improvement was temporary, however, for he was confined to his room for the month of January. In February he commenced treatment again, taking nine treatments, but no improvement followed; his sputum had shown at all times bacilli in enormous numbers.

Case XI.—Dr. J. D., of New York, has kindly sent me a report of his own case, which I submit verbatim:

"Age twenty-seven; physician; father and two cousins on paternal side died of phthisis. Healthy until July, 1880, when I suffered from pneumonia, being at that time in a run-down condition due to over-work. Pneumonia was very slow in resolving; during fall and winter of 1880 had three attacks of hæmoptysis; by spring of 1881 all symptoms of lung disease had disappeared, and until the early part of 1884 I was entirely free from pulmonary troubles. At this time I contracted a cold, and the cough persisted in spite of treatment. During the following winter I had two very slight attacks of hæmoptysis; chest was examined at this time, and gave evidence of catarrh of smaller bronchi; spent February and March at Hamilton, Bermuda, but did not derive the expected benefit which I sought, and suffered from the enervating effects of the climate. During August and September, 1885, sojourned in the White Mountains and gained but a few pounds in weight; returned home somewhat discouraged; having heard a paper on the treatment of phthisis by pneumatic differentiation, read by Dr. H. F. Williams at the meeting of the American Climatological Association, I determined to try the method. In October, 1885, I called on Dr. Williams, who kindly put the apparatus at my disposal. At the time of commencing treatment a physical examination showed some catarrh of the finer tubes; a small area of diminished respiration at the upper portion of the left lung. I coughed all day; cough accompanied with expectoration.

"For the first few weeks used the cabinet three times a week, and later once a week. After the first few *séances* the cough diminished, and in three months had stopped entirely. In a month from beginning treatment had gained five pounds in weight.

"Preliminary and subsequent examination was made by Dr. J. H. Ripley, of New York. Latter examination shows nothing but small area of diminished respiration and slight emphysema. The latter condition was noticed before this treatment was commenced.

"Very truly, J. D."

The doctor omitted to state that for his emphysema he was subjected to two inches pressure in the cabinet and expired into the normal air, from which he frequently experienced relief and benefit.

Case XII.—Miss E., aged twenty; best weight 135, present 117; temperature 102°, P. M.; expansion 1½ inch; spirometer 30; is ignorant of any phthisical history; father and mother dead. One year ago took cold, from which did not recover. Has been under treatment, using

spray, etc., since hoarseness commenced, which was an early symptom; at present voice is very husky, coughs constantly; expectorates yellow and greenish matter, sometimes mixed with blood; averages two cold sweats per week; very short of breath; percussion note is high-pitched in clavicular region of right lung; point of greatest intensity at junction of sternum; note is also high-pitched at outer clavicular angle of left side; auscultation gives a bronchial, harsh, and wavy respiration in upper anterior lobe of right lung; moist râles in profusion on coughing. There are sibilant and sticky râles below point of bronchial breathing; in the left lung the respiration has lost its vesicular element; there is also evidence of pleuritic attachment. Treatment began December 1, 1885, and continued every other day up to December 18th, taking in all ten applications; tincture of iodine sprayed; five to eight tenths rarefaction used. Patient professed improvement at the fifth application, and the respiratory sounds seemed clearer, but the cough, expectoration, and fever did not abate. On December 18th there was no substantial benefit noted, when I advised the suspension of the treatment. Two weeks later she was visited at her home; her lungs were congested, bronchial respiration was more marked than ever, and her fever had increased.

Whether the fever was increased by the use of this method or not, the coincidence at least was striking. There may be conditions where the accidental point of breaking down is in close proximity to the pulmonary lymphatic system, and any considerable force exercised, as in this case of six tenths rarefaction, would tend to more rapidly disseminate the particular virus into the general circulation, and thus more rapidly bring about the necessary conditions to infect the nervous centers that control bodily heat. This is a fair conclusion in this case, though it may be an incorrect one.

Case XIII.—Mrs. L., married, aged thirty-three; best weight 150, present 138½; temperature normal; expansion 1¾ inch; spirometer 150; no history of phthisis; had uterine trouble before marriage; a cough first developed shortly after the birth of a child, one year ago, which has never entirely disappeared; has recently recovered from a severe prostration consequent upon a hæmorrhage following a retained placenta of a three months' miscarriage; has been up and around for the last month; her general condition improving, but her cough growing more severe and expectoration increased; very anæmic, sallow; exertion produces dyspnœa; fremitus increased on right side anteriorly; percussion on right side reveals high-pitched note in clavicular spaces extending to fourth intercostal space. The note is not full in axillary region of left side. Auscultation, right lung; the respiratory sounds are feeble. Forced, they become bronchial with moist râles; in the left upper lobe in front the respiratory sounds are harsh and cog-wheeled in character. Treatment began December 10, 1885, and continued with great regularity up

to January 26, 1886, taking in all thirty-one applications. Rarefaction from four to eight tenths. The agents used in this spray at different times include mercuric bichloride, carbolic acid, ammonium chloride, tincture of stramonium, cocaine, morphine, and iodine. A steam spray was used for a time instead of the compressed air-blast. Artificial respiration usually supplemented the sitting, which averaged from fifteen to twenty minutes in duration. My daily notes show various and conflicting statements, but no steady improvement is recorded. At times she would complain of sharp pleurodynia, and, strange to say, sought the cabinet for relief of this. The mornings after inhaling the iodine the sputum gave a blue reaction upon her handkerchiefs. Her weight, up to January 26th, had not declined, and her temperature remained normal, yet her cough continued, and the result of the treatment has been negative.

Case XIV.—(Referred by Dr. D. C. Dellenbaugh, of Cleveland, Ohio, who in his letter records a morning subnormal temperature and cites the case as a "typical example of phthisis following upon pneumonia, involving nearly the whole of the right lung"):

R. C., aged twenty-seven, single; best weight 138 pounds, present weight 120¼; no phthisical history; "cold one year ago"; confined to bed; coughed ever since; expectoration very free and heavy. For last six months night-sweats; coughs so violently that he vomits; can not take exercise without loss of breath, feeling very weak; abnormal blueness of face and hands, emaciated, deep temporal fossæ, retracting right chest almost a deformity; intercostal depression. On percussion of right anterior upper and outer angle, the note is woody in character; in the scapular region it is of higher pitch than on the corresponding side; the left supra-clavicular space fails in normal resonance.

Auscultation.—Cavernous respiration in right outer apex, extending toward the axillary border; large gurgles; inspiration accompanied with fine râles in mammary region; sputum contains bacilli. Began treatment January 25, 1886, and has continued up to April 17th, taking in all thirty treatments. Took treatment every day for first ten applications, gradually declining in frequency until finally he came once a week. The mercuric bichloride was used (1 to 500), varied at times with the iodine solution, to which eucalyptol was added. Examined April 17th; the cavity has become nearly quiescent; there are no moist râles in mammary region; he estimates the quantity of sputum at two thimblefuls a day; his weight is 127½ pounds.

Case XV.—Sent by his physician, Dr. Guild, of Ware, Mass., who kindly appends the following history: Mr. G., aged forty, unmarried, temperate; one uncle afflicted with asthma; five or six years ago, after a succession of colds which were easily contracted, he complained of shortness of breath; suffered with hay fever from 1870 to 1879; after this and at the time of the beginning of the asthmatic seizures the hay fever did not appear; can not go near a stable without exciting an

asthmatic attack; generally free from asthma while in New York. He is convinced that the locality of his native town (Ware, Mass.) is prejudicial to his case, which is strengthened by his uncle's experience, who could not reside in comfort at home. The physical signs show extreme resonance; auscultation shows absence of vesicular murmur with sibilant râles; heart-sounds heard with great difficulty. There are bronchial and some moist râles.

First treatment February 22d; rarefaction four tenths, with ammonium chloride, for the relief of the bronchial catarrh. The sitting ended by artificial respiration. For the last fifteen applications compression was carried to two inches in the cabinet and the patient allowed to expire into the normal air, inhaling the air of the cabinet. In this way he repeats this act ten to fifteen times a minute. He has taken twenty-eight applications in all; has increased his respiratory power; his heart-sounds are audible; has had no attack since commencing treatment; is now in Ware to determine the effect of the treatment.

Case XVI.—T. F., aged thirty-nine, physician, gives the following history of his own case, and the benefit he derived from a few treatments with the pneumatic cabinet:

"Was attacked with acute pleurisy in July, 1883, slight effusion, etc., followed by cough and prostration, and was confined to the house until May, 1884; then began to improve rapidly, and, by the advice of my physicians, spent the summer in the Adirondacks, and the following winter in southern Georgia; again last summer went to the Adirondack lakes, and in the autumn resumed practice. As far as I know, my only trouble has been pleurisy with its sequels; family history very good; in April, 1884, my chest had contracted four inches (from 38 to 34 inches); weight reduced from 166 to 146 pounds.

"In December, 1885, at the suggestion of my physician, Dr. T. A. McBride, of New York, I applied to Dr. Williams to try the effect of 'pneumatic differentiation' upon my contracted chest. During the time from May, 1884, to December, 1885, my chest measurements only increased one inch, although my weight increased ten pounds; with this condition of my chest I had relatively limited expansion and accelerated respirations, with more or less pain constantly. I think I received in all ten treatments; at first two a week, later one only every week. The result of these treatments has been an improved respiratory mobility; respirations less rapid and deeper; am able to sleep equally well on either side (previous to my first visit I was unable to sleep on my left side), and almost entire freedom from pain in thorax.

"I think that the thorough expansion of the lungs by differentiation has been of great therapeutic benefit, and with the start this measure has given me I have been able to take a large amount of out-door exercise, and a steady improvement has resulted.

Yours truly, T. S."

In these sixteen cases rational auxiliary treatment has not been withheld, nor has it been essentially different in any case from that which had been instituted before coming under my care. In most of the cases I have advised an occasional return for treatment, and an immediate return in the event of taking cold. While these results are largely due to the benefit of expansion and thorough blood aeration, and the consequent stimulation of appetite and assimilation, I think the undoubted influence of deeply introduced medicinal agents in some of the cases must claim a share of the credit.

I can not longer trespass by an extended reference to the remaining twenty-nine cases. Many of these would furnish data like those reported; while none can show a gain of thirty-two pounds, as in Case VII, none have as signally failed as Case XII.

In response to an invitation from me, many of those physicians using the cabinet have forwarded me reports and conclusions gained from their experience with it. With their permission I append them,

From Dr. Classon and Dr. Clarke, of Albany:

"We send you a report of one case in which we expect recovery by cabinet treatment. We expect favorable results in two other cases, but it is too early to say decidedly yet; improvement has followed in three others. G. L., aged nineteen, clerk; weight 139 pounds; single; one sister died of phthisis, aged eighteen; had a hæmorrhage one year ago, followed later by two slight ones accompanied by cough, loss of weight, and recently by night-sweats; expectoration mainly mucous.

"*Examination.*—Percussion; slight dullness over upper half of both lungs, extending a little farther down on right than left side; more marked on upper right side; increased resonance over lower part of both lungs.

"*Auscultation.*—Fine mucous râles over same portion of lungs as dullness; respiratory murmur diminished over upper half of both lungs, and exaggerated over remaining area. Broncho-vesicular respiration over circumscribed area in posterior upper half of right lung (infra-scapular region).

"*Treatment.*—After fourth treatment, began to improve; after sixth, marked improvement, coughing only in the morning; râles clearing up, dullness disappearing, and respiratory murmur becoming more distinct. At the end of the fortieth treatment the left lung was nearly normal; the right still gave the same sign, though less marked in the extreme upper portion—that is, in the supra-scapular region. The remainder of the lung was normal; respiration in the cabinet at first treatment twenty-seven, gradually decreasing to twelve at the seventh, to eight at the ninth, to six at the twelfth, to five at the twenty-second, to four at the twenty-fifth, and remained there up to the present time. Began at two tenths rarefaction, increasing to three tenths at the fourth, four tenths at the

sixth, six tenths at the eighth, eight tenths at the twentieth, and the same throughout. Began with one treatment every other day, and kept that up for thirty-seven treatments; then dropped to one a week, and has continued that to the present.

"Treatment commenced November 2d; took the last April 10th. Diagnosis, acute phthisis.

"Yours respectfully,

"R. D. Clarke,

"F. L. Classon."

Dr. W. Everett Smith, of Boston, who has had a cabinet since December, 1885, reports:

"I do not feel justified in reporting as absolutely cured more than this single case, which I send. But this one case is valuable to me, as showing what can be accomplished in treatment. I have others that might be reported, but they are not so striking, nor should I feel justified in speaking so positively in regard to them.

"J. M. E., clerk, aged thirty, has been troubled with asthma constantly for about fifteen years; has always been subject to colds. In the early winter of 1884 had pleurisy in left side; strength and weight so reduced that he had to give up work and spend the winter in the South; was examined at this time by Dr. J. P. Oliver, of Boston, who said he had tubercular phthisis; has never had hæmorrhage or night-sweats, but in December, 1885, when I first saw him, I found his daily work more than he had the strength to accomplish; slight cough and appetite; no bacilli; chest very flat and emaciated, with a marked tender area in right infra-clavicular space; respiratory act feeble; patient gets out of breath easily; percussion revealed slight dullness at both apices. Auscultation showed inspiratory murmur hesitating at both apices, with occasional slight râles; at the right apex in back were very distinct cracklings; there was an abnormal transmission of heart murmur in right subclavian artery; over the third interspace and about two inches from sternum were stridulous râles; vocal resonance not clear over chest, clearer at apices; expansion one inch; diagnosis, incipient consolidation at apices.

"The treatment has been chiefly in rarefied air, with oil of pine-needles, and later with a creasote and camphor mixture.

"First treatment December 24, 1885. Between this date and February 10th had eighteen treatments; has not been treated since March 15th; has had a total of twenty-three treatments. On April 19th I re-examined him, but can find absolutely no trace of dullness or abnormal respiratory murmur. Patient says he never felt or looked healthier in his life; has not hesitated to be out in all weather this winter, even in night air, a thing he has never been able to do before; has had only one cold, and that very slight; has had no asthma since January 14th, although he has several times run for the cars very hard. Does not easily

get out of breath now; feels that he is stronger, daily work does not tire him; absolutely no cough, appetite hearty, chest thirty-one inches; but expansion the same; tender area in right infra-clavicular space absent.

"Yours very truly,

"W. Everett Smith."

Dr. C. B. Herrick, of Troy, N. Y., says:

"I will attempt, by the following remarks on a few of my cases of pulmonary troubles which I have treated with the pneumatic cabinet, to give you an idea of what I have done in that line and with what success. Upon receiving my cabinet, I, of course, tried it upon myself as well as on my students and others who had perfect respiratory organs. I found after a few trials, in which we could not breathe against more than four- or six-tenths pressure, that we were enabled easily to allow one inch to one inch and a half to be applied. This extra amount of air thrown into our lungs certainly filled us up, and all tight clothing had to be loosened, and acceleration of the heart's action was noticed and, perhaps with one-inch pressure, a redness of the face was apparent; but the more marked effect was the entire satisfaction of having plenty of air to breathe and no work to breathe it. This effect would continue for some time after coming out of the cabinet. Why, even in perfect health, this acceleration of the heart's action, caused as it is by the undue amount of air introduced into the lungs to be arterialized, its more ready arterialization, and with this all a general activity of all the functions of the body, would not this be a good general tonic, and, of course, a perfect immunity against permanent lung trouble? I think the time will come when people will take their treatment as they now do their Turkish and other baths, and the sooner the time comes the better. Now as to a few of my cases.

"Mr. Nathan M. is a machinist, aged forty-five, coming to me July 20, 1885, with the following history: His father died of phthisis; he contracted a cold some twelve months since, and had one slight hæmorrhage. His physical condition is very weak; weight, 120 pounds; respiration, 30 a minute, very short and labored. His expanded chest is thirty-two inches; ribs prominent; right chest revealed dull percussion throughout its upper half; remainder with left side normal. Auscultation shows a solid infiltration in the upper right lung; remainder and right side comparatively normal, save some bronchitis. He took his first treatment July 30, 1885, at a pressure of four tenths of an inch, using as spray iodine and iodide of potassium; his respirations while in the cabinet fell to eighteen a minute; and after ten minutes' treatment he expressed himself as being able to take a deeper breath than he had in three months; he continued with daily treatments under a gradually increased pressure, until at the sixth he had reached seven tenths; respiration outside of the cabinet was now twenty-two; could walk a long distance

without winding. On August 30th, after ten treatments, a re-examination was made.

"A decided change in all the previous conditions; bronchitis absent; percussion dull over left area, more crepitant than mucous râles, showing conclusively a deeper penetration of air in the lungs. He continued daily and tri-weekly for forty-five treatments; his expansion gained one inch, and in weight twelve pounds. Is able to care for himself, and, although not cured, still gave up his treatment, and I have not seen him since.

"Mr. A. G. T., aged twenty-four, weight 128, father and grandfather died of phthisis. He has coughed two years, and has had two or three hæmorrhages. Physical condition fair; slight build. His symptoms have been raising of mucus, sometimes heavy, and with a daily evening fever. Examination shows chronic bronchitis everywhere, and a muffled murmur on the right side. Percussion obscure; diagnosis, incipient phthisis.

"First treatment July 15th, with two tenths rarefaction and with an iodine and iod. potass. spray; respiration fell two acts per minute while in the cabinet. After the fourth treatment the evening fever began to abate, and on the sixth day had entirely disappeared. His expectoration became more frothy and very easy to raise. He took daily treatments, creeping up to seven and eight tenths, using iodine, bichloride, ammonium hydrochlorate, tolu, etc., as sprays. At the expiration of fifty treatments his respiration was normal, weight increased five pounds, gained one inch in expansion, and is working harder than he ever did in his life before, and without any return of his bad symptoms. Has passed the winter north, while that of 1884 and 1885 had to be spent in Florida.

"Mrs. R., aged sixty-three; mother died of consumption; four maternal aunts died of the same disease. She contracted a cough twelve years ago, and coughed until five years ago, when she had an attack of pneumonitis; since then has been raising very little solid sputa, and been reduced in weight and strength until she is a shadow; has had a number of hæmorrhages.

"Six months since she had a second attack of pneumonitis, which laid her very low, and from which she had never recovered. I saw her during July. At this time the following condition was present:

"The upper lobe of right lung was solid on percussion, and on auscultation devoid of air. The lower lobes had râles of every conceivable nature present; the left side was filled with bronchial râles and evidences of infiltration; inspiration was jerky and accompanied with audible sound; respiration was thirty per minute; her condition was very feeble; coughed hard; expectoration heavy, muco-purulent, with some blood. The first treatment was given her September 1st, with one tenth rarefaction; iodine was used for ten minutes; respiration fell to twenty per minute; daily and bi-daily treatments were kept up, she being very plucky, and breathing gradually up to six and seven tenths; remaining in the cabinet for from fifteen to thirty minutes. The medication was iodine, bichloride, ammonium hydrochlorate, and tolu; res-

piration in the cabinet was now, after fifteen treatments, sixteen a minute. In all she took sixty-five treatments, and examination showed an entire absence of râles in the left lung, while those in the right were confined chiefly to the upper lobe. Septum is entirely frothy, no lumps, and diminished in quantity; she is 100 per cent. improved; can walk in the open air unassisted, and has gained five pounds; in expansion she has gained one inch. She left for her home in the country, and has remained in as good condition as when leaving off her treatments. This case especially speaks well for the cabinet. From a mere skeleton, a dying consumptive, she has been brought to look almost the picture of health, is able to care for herself and others as well, and all in a person of her advanced age, and with such a history behind her.

"Miss T., aged twenty-six, came to me, December 21st, with the following condition: A history of pneumonitis from which she never fully recovered; evidence of it yet in upper lobe of right lung. I diagnosticated unresolved pneumonitis.

"This patient began with two tenths pressure and ten minutes at a time. She attained in five treatments a pressure of six tenths, and remained thirty minutes in the cabinet. She improved greatly in breathing and all her pulmonary symptoms, and after fifteen treatments she left me, being greatly improved.

"Besides these special cases I have had a number of others which have responded kindly to the influence of the differentiating process, and who were relieved by treatment. Some were in the last stages of phthisis, but the relief obtained was so great that they would come for treatment until physically unable. In all I have been more than pleased with the effect of this truly remarkable scientific apparatus for the treatment of our most formidable disease, phthisis.

"Very respectfully yours,

"C. B. Herrick."

Dr. W. A. De Watteville, of New York, writes as follows:

"It would be desirable that reports of cases should be more objective in character than is usually the case. Instead of piling up statistics of cases which have been under my care, I prefer to lay before you three types of pulmonary pathological conditions, distinct in regard to their symptoms, and to note the changes produced by pneumo-differential treatment.

"Great accuracy in statement, both as to primary diagnosis and to final results, is necessary, for the primary diagnosis is not so simple as to be free from possible error, and the enthusiastic compiler of his own cases is sometimes apt to make a mountain out of a mole-hill, and record the recovery of a so-called primary infiltration, which, if only a simple catarrh, would have recovered with a week's warm weather and a little cough mixture. If this is not so, how can we explain the wonderful results which appear so often in our journals whenever a new plan for the

treatment of phthisis is described? I shall, therefore, detail three cases which, I believe, are fairly representative of their type:

"Case I.—Miss A. G., aged twenty-six, school-teacher, French nationality, has been in this country for three years; parents both dead, but no phthisical history; had to take a situation as teacher of French in a fashionable school. During the fall of 1884 was exposed to some hardship by overwork and cold room; developed late in the fall a chronic cold; cough; yellow expectoration; loss of appetite; evening fever; loss of flesh and voice; general weakness. Her weight declined from 128 to 98 pounds. She held on to her position until the end of the winter session, and then came to New York to visit friends, and, as she said, to die in peace. She was sent to me to give an opinion as to her chances by pneumatic treatment.

"*Examination.*—Weight 98 pounds, general emaciation, breathing labored, complexion pallid, eyes surrounded by dark rings, temperature 99° to 101°, and pulse feeble.

"*Inspection.*—Expansion, two inches and a half—right side, one inch and three quarters; left side, three quarters of an inch. A distinct hollow under left clavicle; respiratory movement on left side very limited; right side slightly defective; general nutrition and appetite exceedingly poor. Percussion note fair on right side, dull on upper third of left side, with exception of a circumscribed space below clavicle, where it is superresonant, and changes its note on changing the position of the mouth.

"*Auscultation.*—Fine râles and rhonchi on right side, with more or less bronchial breathing; on left side the same symptoms more pronounced; on upper third, expiratory sounds are weak; loud bronchial breathing in apex, with cavernous sounds and gurgling râles under the clavicle. Posteriorly the same symptoms are less distinct.

"Treatment was begun on June 3d, and was repeated daily when the weather permitted it; internal medication was discontinued. The patient was ordered a bottle of Dublin stout at dinner-time. June 10th, objective signs not much changed, a somewhat freer expansion being noticed; voice slightly improved. June 17th, is able to sleep on her back; coughing much diminished, free yellow expectoration, appetite increasing, and night-sweats absent. Râles are coarser in character, and often accompanied with sibilant râles. The respiratory sounds are considerably increased. June 21st, patient had to visit her dressmaker to have her dresses enlarged over shoulders and chest; voice much improved. Is able to take walks and make visits. June 28th, patient can not take treatment on account of heat; appetite not satisfactory; more cough at night and during forenoon. July 5th, treatment has been omitted during heated term; complains of her right side, and can not sleep on it. Appetite not satisfactory.

"Ordered tannate of quinine in five-grain doses three times daily. July 14th, was called to Brooklyn to see patient; she suffered great pain on right side; pulse high, temperature 101°; find that dry pleurisy has

developed over lower half of lung; the patient had that part of the thorax strapped with belladonna strips. July 24th, patient has resumed treatment and feels much better; appetite good. July 31st, improving rapidly; gaining weight fast; appetite excellent; sleeps comfortably on both sides; hardly any cough; voice strong; throat not sore at all; ordered to come bi-weekly. August 14th, continued improvement; râles, with the exception of the space under clavicle, are absent. No difficulty in breathing. Patient leaves to return to her duties in school; her weight is 112, a gain of 14 pounds. November 4th, patient has come to New York on a visit; she is in excellent health; when very tired, she coughs occasionally, and her voice becomes hoarse. She teaches eight hours daily; her weight is 130, general health excellent, appetite as great as ever. Auscultation still yields the bronchial and cavernous breathing under the clavicle. The heart-sounds are heard still, with equal distinction in the right axilla; a few coarse râles are occasionally met with; there is still the evidence of pulmonary lesion, but the patient is satisfied. March 10th, the patient visits at rare intervals; has followed her onerous duties during the winter, and feels stronger than she has for three years.

"Case II.—Miss A. B., aged seventeen; weight 120. Examined September 11, 1886. Father died of phthisis. Had pleuro-pneumonia (?) six months ago, and has never felt well since; cough, fever, and night-sweats; no hæmorrhage; loss of appetite and flesh. Was sent into the mountains of New Jersey without benefit. Yellow expectoration; temperature 102° or 103° in the afternoon. Florid complexion; no emaciation in face; thorax emaciated; clavicles prominent, scapulæ also; respiration is limited and almost entirely confined to lower thorax and abdomen; the upper part of thorax is almost immovable.

"*Percussion:* The note in the supra- and infra-clavicular and scapular regions is wanting in resonance and is high in pitch; no region of absolute dullness can be found, however. Auscultation shows sharp bronchial breathing, with undulatory expiration present at both apices. Fine crepitant râles accompany the end of inspiration and during the whole of expiration. These symptoms diminish as you descend the thorax; the breathing in upper half on both sides lacks the vesicular character.

"Treatment was commenced September 11th and given four times until the 15th. It was then discontinued for ten days on account of hot weather; was then resumed and continued three times a week until middle of October; when she left for home. The inhalations used were iodine, sublimate, chloride of ammonium, and salicylic-acid emulsion. The patient made very little progress during the twelve first treatments, and her condition was discouraging. A rarefaction of nine tenths inch was given, when she suddenly began to breathe fully with her upper thorax. From this day steady improvement commenced and continued. State of health at period of dismissal: Free thoracic breathing; bronchial breathing still present, but vesicular element more prominent; râles ab-

sent, and expectorates very little; no fever; appetite good; increase in weight not measured, but considerable. Present state of health, as reported last week, is excellent.

"Case III.—Mr. A. P., a transitory resident in New York city, has been sent on a sea voyage for the benefit of his health; aged thirty-three; phthisical history on his maternal side. Had a severe hæmorrhage three years ago and was sent to Corsica; has been getting progressively worse; May 24th, he shows absolute weakness, unable to mount a stair, harassing cough; sputa thick, yellow, and streaked with blood; temperature 102–103° in the afternoon.

"*Examination.*—Great emaciation; hectic; cheek-bones, clavicles, and scapulæ prominent; on right side great depression in infra-clavicular spaces. Percussion-dullness in the apex on both sides; under clavicle there is cavernous resonance. Percussion was painful and had to be abandoned.

"*Auscultation.*—Râles of every character are present. Gurgling sounds accompany cavernous breathing in right infra-clavicular space; treatment was administered with great caution, sublimate and pine-needle oil being used. This was continued for six times at a rarefaction of four tenths inch. Patient derived a momentary benefit as his respiration became easier and the expectoration free. Treatment had, however, to be discontinued, as his temperature rose to 105° every evening of the day he had taken treatment, notwithstanding quinine was used in liberal doses. On discontinuance of treatment, the temperature went down to 101°; patient left for the south of Europe, where he died a few weeks after his arrival. I mention this case as a corroboration of what I believe you have already published, that not only did the use of the cabinet in this case not reduce the temperature, but gave some cause of inference that the greatly induced circulation produced an increased temperature. Truly,

"W. A. De Watteville."

Dr. Robert H. Babcock, of Chicago, writes as follows:

"*April 5, 1886.*

"Herewith I send you a report of two cases which I have treated by means of the cabinet:

"I have used the pneumatic differentiator for three months, chiefly in the treatment of pulmonary tuberculosis, and, although my results have not been brilliant, they are to me encouraging. I shall speak of only two cases. These patients came to the Throat and Chest Department of the South Side Dispensary and were selected because of the hopelessness of accomplishing anything by internal treatment. At the same time the usual internal remedies considered appropriate in such cases were not abandoned upon the resort to the cabinet, and in estimating results this fact must be kept in mind.

"Case I.—Mary R. gave following history: Aged thirty, Irish, un-

married, a house servant, began to have a dry cough fourteen months ago, and two months later to expectorate. Eight months ago she ceased to menstruate. Her condition has grown steadily worse until present time. She is now tormented day and night by a hard cough and profuse muco-purulent expectoration; is very weak, has daily fever and night-sweats, no appetite, and complains of much pain across the front of the chest; has no diarrhœa. Upon examination of the chest, consolidation of both apices, particularly of the right, was discovered, together with considerable retraction of the anterior border of both lungs. The only râles heard were pleuritic friction-sounds at either side of the sternum. Her temperature was 100° F.; pulse 92, very weak; respirations shallow, but only 20 to the minute. Treatments with the cabinet were begun January 30th, and continued almost daily except Sundays until the 17th of February. She then remained away until March 1st, when she reappeared with the statement that her menses had returned the 18th of February—that is, the day following her fourteenth treatment. The day of her reappearance her temperature was 99⅘° F., respiration 18. March 9th, it is noted that she had gained one pound in weight. She now came very irregularly for treatments, receiving only seventeen between March 1st and the 24th of April. She reported considerable diminution in the frequency and severity of her cough, a lessened expectoration, slight improvement in appetite, and entire disappearance of the pain in the front of the chest. She was obliged to work far beyond her strength, sweeping, carrying coal, scrubbing the front steps, etc., all of which tended to retard improvement. After a discontinuance of treatments for a few days she invariably complained of increase in the severity of symptoms, notwithstanding faithful adherence to cod-liver oil and tonics. *Per contra*, she as invariably and emphatically testified to a feeling of relief and amelioration of symptoms after each resumption of treatments with the cabinet. In her case a rarefaction of four tenths was the highest she reached. A spray of the mercurial bichloride of the strength of 1 part in 1,000 was administered, and each treatment lasted about fifteen minutes. A physical exploration of her chest the latter part of March showed no improvement in the physical signs. Although in this case the environment of the patient was so very unfavorable and her treatments were from necessity so intermittent, I am yet of the opinion that the use of the cabinet kept her from losing ground, to say the least. Indeed, it is not beyond bounds to assert that as a whole her condition manifested slight improvement. That this was largely due to the cabinet is rendered probable by the fact stated above, that she always came back complaining of an aggravation of her cough and expectoration after an omission of treatments for several days, while after each return to the cabinet her symptoms became less troublesome.

"Case II.—Matilda J. gave the following history: Aged thirty-three, Swede, unmarried, domestic, no family history of tuberculosis; was in good health until five months ago, with exception of some acute abdomi-

nal affection two years ago, for which she was in a hospital. Last fall she developed a cough while sleeping in a damp basement. Since then she has lost weight and strength, and is now unable to work. The cough is troublesome and expectoration is copious—muco-purulent. Examination of the chest disclosed slight dullness in the left supra-scapular and supra-clavicular regions, with broncho-vesicular respiration; no râles. Over the right side the resonance was impaired, except under the clavicle, where it had a vesiculo-tympanitic ring. Below the angle of right scapula, and passing forward into the infra-axillary region, the percussion note was duller than elsewhere. Here the respiratory sounds were faint and bronchial, being almost obscured by plastic exudation râles. Over other parts of the lung the respiratory sound was broncho-vesicular. Vocal resonance over this side was slightly exaggerated. Her temperature at 2.30 P. M. was 96⅗°, pulse 78, and respirations 21. The diagnosis was plastic exudation upon the pleuræ, with slight induration of right lung and slight tubercular induration of the left apex. Treatments with the cabinet were begun March 4th, while at the same time cod-liver oil and tonics were continued. March 15th, after eight treatments, each of fifteen minutes' duration, together with a spray of Lugol's solution, five per cent, the patient's cough had lessened considerably; she felt better generally, with less sense of constriction in the chest. By March 27th, after nine more treatments, she no longer complained of any trouble with her breathing, and her expectoration had become mucous. Her appetite had improved somewhat. At the date of this writing, April 6th, after eight more treatments, her general condition is manifestly improved, and she reports a gain in weight of one pound. Examination of the chest, however, reveals no apparent improvement in the physical signs, except that her ability to expand the chest is greater than a month ago, and the respiratory sounds are more audible. The râles remain as before.

"These two are the only cases in which the treatments were continued by the patients with any degree of faithfulness, and hence they are the only ones I report. As said already, the results are not brilliant, possibly not more favorable than it might be claimed would be obtained by proper hygienic and therapeutic management. Nevertheless, from these and my limited experience in my other cases I derive considerable encouragement. I should not think of relying on the cabinet to the exclusion of all other measures; it is in my opinion a valuable adjunct, and, indeed, it will help the patient acquire what he can not get alone—viz., the ability to inflate his lungs to an extent previously impossible. The benefit of this alone is too apparent to need discussion. This is of very great service in exactly those cases of plastic exudation upon the pleuræ to the disastrous consequences of which Dr. Leaming has called attention, and in which he recommends that the patients be directed to breathe as deeply as possible. In every instance of pulmonary phthisis I have noted the decided effect of this treatment in lessening cough and expectoration where the former was due to collection of secretions within the bronchi

and not to laryngeal complications. Whether this be due to the increased force of the respiratory act alone or to the efficient administration of atomized solutions, which this method renders possible, this influence over cough and expectoration is of such marked benefit as to alone recommend the method. Without wishing to depreciate the value of the topical medication so efficiently achieved by means of sprays used with the cabinet, I am yet inclined to think that the benefit is mainly due to the mechanical effect of the treatment in causing a more active intra-pulmonary circulation, combined with the stimulation of the mucous membrane of the larger bronchial tubes, caused by the more rapid passage over it of the air-current. Not only is the circulation within the pulmonary arterioles accelerated, thus bringing more blood into contact with the oxygen of the inspired air, but that in the bronchial and nutrient vessels is also hastened, a tendency to stasis within them is diminished, the bronchial mucous membrane is kept in a healthier state, the absorbents perform their function more actively, and the nutrition of the lung structure is improved. Were this alone and nothing more the result of treatments with the pneumatic cabinet, this were enough to recommend it to the profession.

"Robert H. Babcock."

Dr. E. L. Trudeau, of the Cottage Sanitarium, Saranac Lake, says:

"So far as I have gone I can bear testimony to the usefulness of this mode of treatment in certain forms of pulmonary diseases. It has seemed to me most beneficial in those phthisical cases where most good might be expected from expansion and consequent improved pulmonary nutrition, and that the results are much less satisfactory where localized antiseptic treatment has seemed the first indication to be fulfilled. Briefly, in incipient phthisis with apical lesions and slight constitutional disturbance, and in the various forms of chronic phthisis, but especially where malnutrition, debility, and dyspnœa are principally dependent on the evil effects of the contraction of connective tissue in the lung, its most brilliant field of usefulness is to be found. In rapidly advancing excavation and in scattered tubercular lesions it is of little avail. Most patients coming under the head of incipient and chronic phthisis treated by this method at the Saranac Lake Cottage Sanitarium showed more or less marked improvement. In one case a gain of seventeen pounds weight with an entire disappearance of all moist sounds in the lung occurred. Under its use, weight, breathing power, digestion, and occasionally cough improved; it had less effect on the fever and expectorations; slight hæmoptysis occurred in one case only. Very numerous observations showed that the tubercle bacillus and the putrefactive bacteria in the expectoration were generally unaffected by inhalations of 1 to 1,000 bichloride of mercury and five-per-cent. solutions of carbolic acid even when such treatment was continued for several months. In one case the tubercle bacillus dis-

appeared temporarily. The study of this case, however, is still uncompleted.

"E. L. Trudeau."

Dr. Fernald and Dr. Cutts, of Washington, D. C., who have been using a cabinet for the past three months, write that, while they have treated a number of cases, sufficient time has not elapsed to justify them in making a general report. They have had one case, however, which they report in full:

"Sophie S., white, aged eighteen, single; seen by us for the first time March 16th, with following history: Has been losing flesh and strength for six months, during which time she has had an annoying cough, night and day; considerable expectoration, muco-purulent in the morning, at other times frothy and white; five months ago had one slight attack of hæmoptysis; slight daily hectic for last few weeks; night-sweats every night for past week; about middle of January applied at a dispensary for treatment for amenorrhœa; appetite fair; digestion good; sleep restless.

"*Family History.*—No phthisis; one uncle has asthma; father died of pneumonia.

"*Inspection.*—Fairly nourished; complexion sallow; under left angle of jaw an old cicatrix from scrofulous glands; no depressions or deformity of chest; both sides alike; heart normal; pulse, 90; respiration, 25; temperature, 99·8°, 4.30 P. M.; weight, 102.

"*Palpation.*—Slight increase of vocal fremitus below the left clavicle as far as upper border of second rib, and within mammary line.

"*Percussion.*—Slight dullness over the above-mentioned area and above the clavicle in addition.

"*Auscultation.*—Slight increase of vocal resonance over the dull area; jerky respiration (both inspiration and expiration) over whole upper third of left lung; abundant fine mucous râles and an occasional sibilant râle in same lung, in supra- and sub-clavicular space and in supra-scapular region.

"*Treatment.*—In addition to the treatment by the cabinet, she had been taking phosphatic emulsion for two months before coming to us, and continued to do so for two weeks later; by our advice she has taken a simple bitter before meals; at one time, early in the treatment, quinine was thoroughly tried to eliminate intermittent fever as a cause of the daily rise of temperature, but it had no controlling effect, and was afterward discontinued.

"She has had daily sittings except on a few occasions, when kept away by rain; has had thirty sittings to date; from the fourth to the twelfth sitting a preliminary rarefaction was made of two and a half inches for five minutes; since the twelfth, two inches for five minutes. Creasote was used in the spray for first nineteen sittings; since then Lugol's solution, either alone or with creasote; and on several occasions a few drops of pine-needle extract have been added. Patient breathed against one

tenth of an inch for three minutes at first sitting; at each time after this the rarefaction was gradually increased until, at the eighth sitting, was able to breathe against four tenths for eight minutes; for the last eleven sittings, eight tenths for twelve to fifteen minutes, which seems to be as much as she can endure. Her condition began to improve from the first; has had no night-sweat since the third sitting; after the eighth sitting, has had practically no cough or expectoration; fever has gradually diminished, and for last ten days has had none; at no time since treatment began has temperature been found by us, at time of sitting, above 99·8°; at the eighteenth sitting she had gained two pounds, was sleeping and eating better, and in fact was better in every way. Her condition continued to improve, and at the twenty-seventh sitting her weight was one hundred and ten pounds, having gained eight pounds since her first treatment. Her complexion is clearer and her whole appearance is brighter and healthier. An examination of chest was made on the 24th instant (thirtieth sitting). Both sides of chest normal in every respect, except that jerky respiration at the upper part of left lung remains, but is now heard only on inspiration, and is confined to a more limited area.

"Respiration reduced to twenty on outside and eighteen inside cabinet.

"Yours very truly,

"H. M. Cutts,

"F. C. Fernald."

Dr. J. H. Blanks, of Meridian, Miss., sends a tabulated statement of twenty-seven cases, with diagnosis and result, and a sketch of two cases as follows:

	No. of cases.	Recovery.	Improvement.	No improvement.	Deaths.
Bronchitis	12	9	2	1	
Asthmatic bronchitis	1	.....	.....	1	
Acute phthisis, first stage	3	1	1	1	
" " second stage	1	.....	1		
" " third stage	4	.....	.....	.....	4
Chronic phthisis	4	.....	3	1	
Unresolved pneumonia	2	1	1		
Total	27	11	8	4	4

"The cases reported in the death-list were all advanced. The patients were unable to walk unaided, greatly emaciated, with large cavities, and an evening temperature from 103° to 105°. One of them was under treatment four days only. The three others were greatly benefited. They expectorated freely after each application, could breathe easily, and were very much aided in procuring sleep. They were always greatly disappointed when they were prevented from any cause from receiving treatment, as they said they could breathe and sleep so much better.

"The history of one case of phthisis, under head of improvement, is as follows:

"Mr. M., aged twenty-two; best weight one hundred and fifty-eight; present weight one hundred and seventeen. Two brothers died of consumption and one of supposed pneumonia. Patient contracted measles sixteen months ago, since which has had a cough. Eight months ago had several hæmorrhages, and has rapidly declined since. He was first seen by me December 15, 1885, when the following notes were recorded:

"*Inspection.*—Shows marked depression in left subclavicular space.

"*Palpation.*—Increased vocal fremitus left side.

"*Percussion.*—Left side: forcible percussion shows tympanitic quality about third intercostal space; posteriorly there is dullness.

"*Auscultation.*—Left lung anteriorly shows marked amphoric respiration in subclavicular region, and gurgles heard at forced expiratory effort. His temperature was 102°; pulse, 100; respiration, 30.

"*Treatment.*—He was placed in the cabinet, and breathed against two tenths of an inch fall of the barometer for fifteen minutes, inhaling a one to one thousand mercuric bichloride solution; next day, three tenths of an inch pressure, and was gradually increased daily till eight tenths was reached, at which he continued throughout the course of treatment.

"*December 19th.*—Temperature, 102°; pulse, 100; respiration, 28.

"*23d.*—Temperature, 100°; pulse, 90; respiration, 26.

"*28th.*—Temperature normal; respiration, 24; pulse, 86.

"*January 20th.*—He feels 'as well as he ever did in his life.'

"He now weighs one hundred and twenty-five pounds—a gain of eight pounds in thirty-five days.

"*February 15th.*—Continued improvement, but still has a 'slight cough.'

"Physical examination now discloses absence of moisture in the cavity. Posterior dullness cleared up.

"*March 1st.*—Expresses a desire to resume his work as a laborer. Treatment now to be three times a week.

"*April 1st.*—Cough more troublesome, but feeling well.

"*12th.*—Left for southwestern Texas, to engage in work as a laborer.

"The case of acute phthisis reported as cured had the following history:

"Mr. J., aged thirty-four; best weight, one hundred and thirty-five; present weight, one hundred and fifteen. Mother died of consumption. Had cough about two months, accompanied by free expectoration and slight fever in afternoons, rapid emaciation, general weakness, etc. For several weeks had an evening temperature of 101°. He was first seen by me December 24, 1885. His general appearance was that of anæmia; slight depression of infra-clavicular region left side. Increased vocal fremitus, slight dullness, puerile respiration on right side, etc. Thirty applications were made, when his cough ceased, dullness cleared up. He is now (April 25, 1886) perfectly well, and has regained his normal weight."

Dr. A. S. Houghton, of Chicago, says:

"The report of cases treated by me in the pneumatic cabinet, as published in the 'Journal of the American Medical Association,' November 7, 1885, is amended to read as follows:

	No. of cases.	Recovery.	Improvement.	No improvement.	Deaths.
Chronic bronchitis	9	5	1	3	
Asthmatic bronchitis	2	1	1		
Spasmodic asthma	2	1	1		
Acute phthisis, first stage	12	6	5	1	
" " second stage	4	.....	1	1	2
" " third stage	6	1	1	1	3
Chronic phthisis	7	1	1	3	2
Unresolved pneumonia	1	.....	1		
Total	43	15	12	9	7

"Of the nine patients unimproved, seven took less than three treatments. The three reported as recovered last November are in perfect health to-day. No. 3, about whom there was some dispute, called on me January 4th, reporting herself as having been free from cough since September; able to sing every day, as required by her profession, and weighing 146 pounds, a gain of twenty-one pounds since I first saw her. She wrote me April 18th as follows: 'I am still enjoying good health; weigh 140.' That is what I understand by the term recovery. The two other patients are discharged and are in good health, one gaining seventeen and the other eleven pounds. Of the five improved, three are in California.

"A. S. Houghton."

Professor James T. Whittaker, of Cincinnati, in closing the discussion upon the paper recently read by me before the American Medical Association, informally reported on cases treated by him with this process. He had found its effects pronounced and satisfactory. He spoke of patients with tuberculosis who had recovered. He declared that patients incapable of recovery became fascinated with the treatment, and it was necessary in many instances to restrain their demands for its administration when unwarranted, except by their desire. He declared himself an enthusiastic adherent of the pneumatic differential process, which he considered of inestimable value.

Dr. Whittaker is reported as having said, in a discussion before the Kentucky State Medical Society, that pneumatic differentiation had, he thought, entirely changed the prognosis of tuberculosis.*

* "Gaillard's Med. Jour.," Aug., 1885, p. 208.

Recognizing first the importance of systematic microscopical examination of phthisical sputum, secondly the wide numerical variation of bacilli on two slides of the same material, and third the difficulty of expressing their numerical value for comparison, Mr. Ketchum, who has conducted these examinations, has adopted the following system:

A comparatively equal distribution of bacilli is accomplished by a thorough trituration of the sputum for ten minutes in a sterilized mortar. Each examination consists of the thorough survey of six slides, three of which have been stained by the Ehrlich method as a test, and three by a modification of the Rindfleisch method. Exact values, based on number of individuals to given areas after the blood-corpuscle method, are impracticable, owing to the time necessary, and the impossibility of getting all bacilli in a given field in the same optical plane; consequently a table of estimated values has been established as follows: One, is occasional; two, medium; three, numerous; four, large quantities; five, *en masse*. Specimens have been identified by numbers and not by name of donor, so that an unprejudiced estimate could be made.

These examinations have shown increase, decrease, or absence of bacilli coincident with progressive symptoms, improvement, or absolute quiescence. In Cases IV and VIII of my report the evidence is corroborative of an inherent antagonism between the *Bacterium termo* and the bacillus of tuberculosis. So far as they go, they substantiate the advanced reports of Professor Cantani, of the Turin biological laboratory.

I am sensible of the incomplete manner in which I am obliged to record interesting data in many of these cases. Taken in conjunction with my previous report, they will be seen to supply some deficiencies there existing. My original position with reference to the pneumatic differential process seems substantiated. Numerous possibilities will demand close attention and prove a fruitful source of study and application. Some of these I have pointed out in a paper which I had the honor to present recently to the American Medical Association in St. Louis.* Certain facts have been demonstrated. Let them stimulate us to further accomplishment.

* "Jour. of the Am. Med. Assoc.," Aug. 14, 1885.

Paper.

TEN MONTHS' EXPERIENCE WITH PNEUMATIC DIFFERENTIATION.

By VINCENT Y. BOWDITCH, M. D.

Mr. President and Gentlemen of the American Climatological Association: At the request of our secretary I appear before you to-night to give you the results of my experience in the last ten months with the "pneumatic cabinet" or "pneumatic differentiator" which Dr. Herbert F. Williams has introduced to the profession, and in asking your attention for a short time I shall endeavor to give you such thoughts and suggestions as have a practical bearing upon the use of the instrument to which our attention has been called so much of late.

We have had earnest and able discussions upon the physical properties and physiological effects of the cabinet, and it is now time for the profession at large to investigate the clinical results of this new method of treatment and to determine slowly and with fairness the position which it is finally to take in pulmonary therapeutics.

In giving my results, I bring before you no brilliant array of "cures," and to some the record may perhaps appear to be rather discouraging when compared with others in which the results obtained are apparently so much more successful than my own, but, when I tell you that my experience has encouraged me to continue the use of the cabinet in its improved form, it may convince you more strongly than mere words that I believe the instrument will find its place as a valuable addition to our methods of treatment in pulmonary diseases. Its true place can not be established until the experience of careful observers has been given to us years hence, and I wish to add my voice in urging the profession to investigate the matter fairly, and time alone will show whether the hopes of the strongest advocates of the cabinet are to be realized or not.

It will be impossible to give you detailed reports of my cases this evening, for I should consume too much of your time and weary you unnecessarily, but I shall endeavor to give as brief a *résumé* as possible of what has been accomplished, leaving the detailed accounts to be published with this paper, to be read by those who may feel interested in judging of the justice of my conclusions.

The usual meagerness of description in printed records of cases, and the consequent inability of the reader to judge of the fairness of the author's conclusions, must be my apology for publishing what may seem to some too detailed accounts of my own cases.

Since June 30, 1885, I have treated twenty-seven cases with the pneumatic cabinet, the various affections being classed as follows: Pulmonary tuberculosis in its acute and chronic forms; phthisis, both non-tubercular and of questionable tubercular origin; bronchitis in its acute and chronic forms, with and without emphysema and asthma, and retraction of the lung from long-standing pleuritic effusions.

In this classification I have used the term tuberculosis in those cases only in which bacilli have been found in the sputa.

Of *two* cases of well-advanced *acute tubercular disease* (Nos. 1 and 2), there was marked alleviation of symptoms in one, and in the other no benefit at all was noticed.

Of *three* cases of *incipient pulmonary tuberculosis*, two (Nos. 5 and 7) received, in four and eleven treatments respectively, no benefit, and one (No. 24) was *cured*.

Of *three* cases of *chronic bronchitis*, one (No. 20) took but one treatment, another received no benefit (No. 18), and the third (No. 23) received moderate benefit.

Of *ten* cases of *chronic pulmonary tuberculosis*, two, not far advanced (Nos. 9 and 11), received such benefit that for varying periods they could have been called "well" except for the physical signs which proved the contrary, two (Nos. 3 and 22) received little or no benefit, four (Nos. 4, 6, 12, and 15) received marked benefit for several months, and one case (No. 21) received slight benefit in a few sittings.

Of *three* cases of well-advanced *phthisis*, probably tubercular, one (No. 8) received temporary benefit, another (No. 14) little or no benefit, and the third (No. 17) marked benefit for several months.

Of *three* cases of simple bronchitis varying in intensity and duration (Nos. 16, 19, and 27), great improvement was noticed immediately after treatment was begun, and two may be said to have been cured, although I have not tabulated them as "cures."

Of *two* cases of retracted lung from either long-standing empyema (No. 10) or serous pleuritic effusion (No. 25), marked benefit was noticed.

In *one* case of *non-tubercular phthisis* (No. 13) great benefit was noticed.

In *one* case of *tubercular bronchitis* which has only lately begun to take treatment (No. 26), temporary benefit can certainly be noticed.

Table showing the Proportion of Cases of Benefit from the Use of the Cabinet.

None.	Very slight, moderate, or temporary.	Marked for varying periods.	Remarkable.	Cures.	Treated but once, and not taken into calculation.
Nos. 2, 3, 4, 5, 7, and 18 (5 in all). 19+ % of whole number treated.	Nos. 8, 14, 21, 22, 23, and 26 (6 in all). 23+ % of whole number treated.	Nos. 1, 4, 6, 10, 12, 13, 15, 16, 17, 19, 25, and 27 (12 in all). 46+ % of whole number treated.	Nos. 9 and 11 (2 in all). 7+ % of whole number treated.	No. 24. 3+ % of whole number treated.	No. 20.

In thus tabulating my cases in regard to the comparative number which have been benefited by the treatment, I think I can in justice say that, if I have erred in either direction, it is in not giving the cabinet sufficient credit for what has been accomplished. As an instance of this, I can cite the three cases of bronchitis (Nos. 16, 19, and 27) which I have included with those in which "marked benefit" was noticed, and not with those in which "remarkable benefit" followed the treatment, and yet even with a disease of this nature, which we know usually is cured in time without medical aid, the sudden cessation of marked symptoms after the first or the second sitting was something which the most prejudiced observer could hardly have failed to notice.

You will remark that out of the twenty-six cases of various pulmonary diseases treated, I have recorded but one as a "cure," and this leads me to say I can but think that in many of our records of cases we are more hasty in giving such results than justice would allow. "Arrest of disease," in which symptoms apparent to the eye and ear have ceased completely for a time when morbid signs still exist in the body, is a very different thing from "cure" in which every morbid sign, both objective and subjective, has disappeared. We so often read of "cures," and upon strict inquiry find that a renewal of morbid symptoms has begun soon after the reported favorable termination, and the oftener we hear of these cases the more skeptical we become in reading of the successful experiences of physicians who neglect to give sufficient data in their records, and are too hasty in coming to positive conclusions. To illustrate my meaning, allow me to read the records of two of my cases, Nos. 9 and 24.

In case No. 9, for four or five weeks, as far as external appearances were concerned, one would have been perfectly justified in discharging the patient as "cured," but the subsequent history proves the injustice of such a claim. In the other, however, the complete disappearance of every morbid sign, both subjective and objective, is sufficient ground for me, I think, to allege a "cure" even in the short time which has elapsed since treatment ceased. To allay possible doubt in the minds of some as to the presence of bacilli in the sputa in this case, I will merely add that they were found by my assistant and their presence corroborated by Dr. W. W. Gannett.

In giving treatment with the cabinet I formerly used from 0·8 to 1 inch depression of the barometer (that is to say, of course, from 0·4 to 0·5 of an inch as marked on the U-tube of the cabinet), but I now rarely go beyond 0·6 of an inch, as it seems to accomplish its purpose as well, and is not so apt to weary the patient. In every case except one I have exhausted the air always, but in one case of chronic bronchitis with slight emphysema I have reversed the process as an experiment for six sittings by compressing the air in the cabinet, but resumed the former treatment, no special difference in the general signs being noticed in the change. I have had no cases of very marked emphysema, and therefore am unable to say from my own experience whether rarefaction or compression of the air in the cabinet should be used. It certainly seems rather paradoxical that an emphysematous lung should be benefited by breathing into an atmosphere denser than that surrounding the body, but Dr. Williams has had two or three cases which have nevertheless improved under this treatment. We can not suppose that the elasticity of the lung will be increased when the elastic tissue has diminished or disappeared, as in the case of emphysema, and improvement can only be explained, I think, by the tonic effect which the treatment seems to have. The treatment by alternate rarefaction and compression I am unable to speak of, as the cabinet in my possession at present is not constructed like the more recent ones.

The various medicaments which I have used in the spray are as follows:

1. ℞ Tincture of iodine..... ♏xlviij;
   Gardner's pine-needle extract..... ♏xv;
   Glycerin..... ʒj;
   Water..... ℥iv.

Mix and use as a spray.

2. ℞ Phenyl ..... gtt. xxx ;
   Glycerin ..... ʒ ij ;
   Water ..... ℥ viij.
3. ℞ Creasote ..... gtt. v–x–xx ;
   Glycerin ..... q. s. ;
   Camphor-water ..... ℥ j.
4. ℞ Corrosive sublimate ..... 1 gramme ;
   Glycerin ..... q. s. ;
   Water ..... 1,000 c. c.
5. ℞ Comp. tincture of benzoin, } ..... āā ʒ ij ;
   Tincture of cubebs, }
   Tincture of hops ..... ℥ j ;
   Carbolic acid (pure) ..... ʒ ss. ;
   Glycerin ..... ʒ iij.

Mix and use as spray.

Camphor-water has been used alone also, and "terebene," a preparation of oil of turpentine with sulphuric acid, has been used by pouring a few drops on a cloth tied over the end of the inhaling tube in one case of chronic bronchitis. Of these I give no special preference to any one, but I rarely use the iodine spray now, as it seems more irritating and causes more cough in the cabinet than the other solutions. Phenyl seems often to have a soothing effect upon the throat, and its deodorizing power was very marked in one case with offensive sputa. The compressed-air spray has been used in every case except in those of retracted lung from old pleuritic effusions in which no spray was used, and in one case of chronic bronchitis (No. 23) in which I tried the steam spray, with the benzoin solution (No. 5), without marked effect.

Of the germicidal effect of any of these inhalations in the lungs themselves I am very skeptical, and the only supposition which seems to me at all plausible is that they may possibly make the unaffected portions of the lung an unfavorable bed for the bacilli. Even in the case of the corrosive-sublimate solution in strength of 1–1,000, we can not calculate possibly how much of the spray had been made inert by its contact with albuminoid matter before it reaches the lungs.

As to the amount of spray carried into the lungs, I can not help thinking that even five per cent. of the whole amount used is a generous estimate. By a set of experiments I have been led to believe that not more than five or six per cent. is carried into the mouth, and of course it is impossible to calculate how much of this is deposited in the oral cavity, the pharynx, larynx, and trachea.

Having recorded the results of treatment and the methods pursued, I will now speak of the unpleasant or dangerous symptoms which may have occurred at any time while the patients have been in my care. The first and most important is that of *hæmorrhage.*

In the twenty-seven cases which I have treated, apart from the mere occasional expectoration of bloody sputa, which is of such frequent occurrence in all phthisical patients, I have had four cases of hæmorrhage, none of them occurring during treatment. Of these, one only was very severe in a case (No. 7) of incipient tuberculosis combined with acute bronchitis, in which the cough had been one of the most distressing I have seen, and the hæmorrhage occurred *three days* after the use of the cabinet and immediately after a long and severe fit of coughing.

In the second (No. 4), a long-standing case of chronic tuberculosis, in which there had been slight hæmorrhages before I saw the patient, there was a moderate hæmorrhage, occurring several hours after treatment, followed by two or three slight ones in the succeeding fortnight. After cessation of treatment for about a month, it was again begun, and no further trouble has been experienced, and improvement has again been noticed.

In the third (No. 15), a long-standing case of chronic tuberculosis, in which there had also been slight hæmoptysis before the patient visited me, a mouthful of blood was raised *fourteen hours* after treatment, and coincident with acute congestion of the lower part of one lung, followed by acute pneumonia, which terminated in the death of the patient four days later, the attack being attributed to fatigue and exposure to wet.

In the fourth (No. 11), a case of chronic tuberculosis not far advanced. There was a very slight hæmorrhage (about one third of a tumblerful of blood) *forty-eight hours* after treatment, and no ill effects noticed.

From the records of these cases I can not believe that we are justified in attributing the cause of the hæmorrhages to the use of the cabinet, and certainly, from my experience thus far, the amount of benefit derived from its use greatly exceeds its possible disadvantages. The only symptoms complained of occasionally in the cabinet have been slight fullness of the head, or headache when beginning treatment, and of weariness; but these sensations are exceptional. The exhilarating effect of the treatment, on the contrary, has been frequently spoken of by the patients.

I can not help hoping that the cabinet may yet show that its largest sphere of usefulness will be in those cases where the morbid process has only just begun. In my selection of cases I have refused none, no matter how far advanced, provided they could accommodate themselves reasonably to my demands, and in some cases, where all other treatment seems to have failed, the cabinet has been of assistance. I believe, too, that good effects are sometimes seen after patiently giving the treatment for several weeks under the most discouraging circumstances, and I therefore advise that, unless marked deleterious effects are noticed, treatment of chronic cases should not be abandoned too early, and the good effect may be then noticed after the cessation of treatment. On the other hand, I now refuse all cases which can not be within reasonable traveling distance of the cabinet, for long journeys are apt to counteract all the possible good effect of the treatment.

In all records of cases it is impossible to convey to the reader by words the same picture which the writer has in his mind after watching patiently, it may be for months, the condition of the patient under his care. Possibly it may seem to some who read the records of my cases that I have claimed too much, in which case I can only ask those who doubt to make a fair trial of the cabinet themselves, and to give their results to the profession, for in this way only can we arrive at just conclusions.

My opinion, then, of the "pneumatic cabinet" may be thus briefly stated: That, although in my hands it has not accomplished perhaps all I had been led to hope, yet I still feel that it has, at least, shown itself to be a valuable aid to us in pulmonary therapeutics, and I look with hope to see what it can accomplish in the future. I feel strongly that it is not yet safe to intrust it to any other than a physician's care, or to that of an intelligent assistant, for we are not yet sufficiently sure of its power for good or possible harm, and therefore, while I believe it should be thoroughly tested in hospitals and in private practice, the greatest care should be taken not to allow it to fall into the hands of unreliable persons.

If the future should possibly show that the treatment of pulmonary diseases by means of "pneumatic differentiation" has not accomplished all that has been asserted for it, we have at least the proof that the cure of phthisis is not to be accomplished by means of antiseptic inhalations as thus far used, for it is hard to conceive of any more thorough method than this of bringing vapors into direct contact with the lung tissue, and for this result alone the pro-

fession would owe a large debt of gratitude to the originators of the pneumatic cabinet.

In conclusion let me say that, while I have been pleased with the tone of the medical press in many cases in the criticisms of this new method of treatment, I have regretted the ungenerous and rather ill-natured remarks which have occasionally appeared in articles during the past year.

Honest criticism from those whose desire is to do their share in the progress of medical knowledge should be encouraged as freely as unjust fault-finding, from whatever cause it may arise, should be condemned by our profession.

Of my belief in the sincerity and single-mindedness of the originators of "pneumatic differentiation" in their desire to have its merits thoroughly and fairly tested, and its true position determined by the profession at large, I am glad thus publicly to give my testimony.

Case I.—June 30, 1885. Mrs. F., aged twenty-three; married one year; no children; father died of consumption; mother and one brother living and well. Patient perfectly well up to six weeks previous to first visit; never had had the least cough before; took cold, had headache, two weeks later cough began with yellowish sputa, both symptoms increasing steadily, feverishness, vomiting; once copious night-sweat; pain at first in right shoulder; none since; at times much dyspnœa and sense of oppression on chest; marked loss of flesh (twenty pounds); constipation; amenorrhœa for two months.

Physical Examination.—Face pinched, dusky, with a very phthisical look; chest emaciated and rather hollow; gait stooping; dyspnœa very marked; percussion shows slight inelasticity in the right chest compared with left; in back, dullness throughout right. Auscultation reveals less distinct respiration on right than left front, and after cough faintest possible "crumpling" in the lower part of right; voice nearer on right, but not bronchial. On the back, faint "crumple" with cough and full inspiration, most marked in lower part of right; voice nearer and rather bronchial in character; expiratory murmur more marked; respiration throughout right of rather bronchial character; pulse 116; temperature 100·2°; examination of sputa reveals bacilli.

Diagnosis.—Acute pulmonary tuberculosis. Patient was examined by Dr. H. I. Bowditch and later by Dr. Herbert F. Williams, and a grave prognosis given. In the following four weeks the patient took twelve or thirteen treatments in the cabinet, using iodine alone or iodine with Gardner's pine-needle extract as an inhalation, and, although the physical signs showed a steady increase of the disease, the most distressing symptoms—viz., cough, loss of sleep and appetite, and dyspnœa—were

greatly relieved. The expectoration became more profuse, but the voice grew stronger and the general condition improved.

From August 1st to September 23d (about seven weeks) the patient continued to come in from Cambridge three times a week with occasional omissions, but grew gradually weaker, although suffering very little from the previous symptoms, except vomiting. Physical examinations during this period showed increased consolidation of the right lung in the lower part and signs of the formation of cavities, marked by increased dullness, with coarse and fine bubbling râles, bronchial and amphoric breathing in different portions of the lung. Temperature and pulse were usually slightly elevated. From September 23d to October 25th the patient was too weak to come in town, and at the last examination evidences of a large cavity in lower part of the right lung were found. Patient died October 26th, about four months after the first treatment. Patient took thirty treatments in all, using from 0·2 to 0·8 depression of the barometer.

The compound tincture of cinchona in drachm doses was ordered at first and a cough syrup; afterward "bovinine" was given, and a zinc and belladonna pill for night-sweats.

Synopsis of Case.—Acute pulmonary tuberculosis in advanced stage. Treatment given thirty times.

Result.—Marked amelioration of most distressing symptoms; death of patient in four months.

Case II.—July 2, 1885. Miss F., aged fifteen; father healthy; mother died of consumption. Patient was well until about one month before first visit; slept with her mother before the latter's death; first had pain in left side, later a dry cough, scanty expectoration; once a small amount of blood; slight dyspnœa upon exertion; headache, loss of flesh and strength, appetite good, vomits when coughing, bowels regular, never flushed nor chilly, menses regular. All the unfavorable symptoms had greatly increased when I first saw her, and the cough was very troublesome.

Physical Examination.—Patient thin and tall, bright-eyed, rather puny. Percussion reveals rather less resonance than normal in upper left chest; dullness in lower third of left back. Auscultation reveals a slight crepitus under left clavicle. In back, rather less vesicular respiration on left, with a slight "crumple" at the top and fine crepitation in lower third. Power of chest expansion, 33 to 34 inches; temperature 99·2°; pulse 84. Bacilli were found in moderate quantities in the sputa.

Diagnosis.—Acute pulmonary tuberculosis. Patient examined by Dr. H. I. Bowditch, and a very grave prognosis given. Between July 2d and August 10th, when the patient ceased coming, she took nineteen treatments, taking iodine with pine extract chiefly, and once or twice carbolic acid, 1 to 200, and $HgCl_2$, 1 to 2,000, as an inhalation. From 0·2 to 0·8 inch depression of the barometer was used generally. At the last examination, August 10th, the dullness in the lower left back persisted,

the râles were of a coarser character, and in places the respiration was bronchial.

With the exception of a slight increase of strength for a short time, I could not see the slightest benefit from the use of the cabinet in this case. The patient was imprudent and never seemed to take the treatment easily. After August 10th I did not see her again, but heard that she died October 6th, about two months later, with all the symptoms of rapid consumption. The only medicine given was the compound tincture of cinchona at first, and later Fellows's syrup of the hypophosphites.

Synopsis of Case.—Acute pulmonary tuberculosis. Treatment given nineteen times.

Result.—Little if any benefit obtained from the use of the cabinet. Death of patient in three months.

Case III.—July 6, 1886. Mr. J., aged thirty-five, gas machinist; family history negative; patient believes his mother died of consumption; formerly strong and well; four years ago had what was called "slow fever"; has had much trouble with his stomach, unable to digest food, and often obliged to vomit it; had a cough all through the preceding winter; in March got chilled in a cold house; confined to bed three weeks, with almost constant vomiting; cough increased with copious, darkish sputa, then whitish, once streaked with blood; pain in left side occasionally; at first night-sweats; dyspnœa; loss of strength and flesh; chief complaint is of cough and gastric symptoms.

Physical Examination.—Patient does not look very ill; no emaciation; face florid, rather tired expression; percussion note dull at right apex. Auscultation reveals a "crumple" in the right apex; voice nearer in this region; in the upper right back, a slight "crumple"; at left apex about spine of scapula somewhat prolonged expiration; no râle; temperature 100·1°; pulse 106; bacilli found in moderate quantity in sputa.

Diagnosis.—Pulmonary tuberculosis. Examined by Dr. H. I. Bowditch, and grave prognosis given. Churchill's compound syrup of hypophosphites and a cough syrup were ordered. August 5th, one month later, no improvement was noticed, the gastric symptoms being very troublesome and not relieved by remedies used. The physical signs in the right side slowly increased, and about five or six weeks later an occasional râle could be heard in the upper part of the left chest. The cough increased. Pleuritic pains in the left side appeared, and on October 5th dullness was noticed below the third rib on the left side, and moist râles could be heard throughout the left side, most marked at the top, and respiration in the upper right chest was somewhat bronchial, with prolonged expiration. The patient was very much thinner and weaker. I advised discontinuance of treatment, feeling that it was of no benefit. Patient took thirty-two sittings in all, omitting one occasionally. Iodine and pine extract chiefly used in the spray.

Synopsis of Case.—Pulmonary tuberculosis; treatment given thirty-two times.

Result.—No benefit from the use of the cabinet.

Case IV.—July 7, 1885. Sent to me from Dr. J. S. Greene, of Milton. Miss D., aged twenty-one, mill hand; father died suddenly; asthmatic; mother and four sisters all healthy; no history of lung trouble in family. Patient never robust. Has had cough for eight years, varying in intensity, with yellowish sputa occasionally streaked with blood. Cough became worse last autumn, with occasional pain in left chest. Palpitation at times. Feverish and chilly occasionally. Night sweats six months ago. Loss of flesh and strength in the last year. Easily fatigued. Appetite poor. Bowels regular. Menses regular. Obliged to give up work on account of weakness.

Physical Examination.—General aspect, rather thin. Right clavicle more prominent than left. Percussion-note dull, inelastic at upper left, most marked at apex. Auscultation reveals numerous coarse and fine râles in the upper left chest, with prolonged expiration; fine râles most marked above clavicle. Slight "crumple" in upper right as far as second rib. Voice nearer on left. In the back a "crumple" heard in upper third of left side. Heart's action very rapid. Marked blowing diastolic murmur heard most distinctly at third left intercostal space, near sternum. Pulse 138, temperature 102·8°.

Diagnosis.—Phthisis, probably tubercular. Prognosis bad.

Owing to the cardiac murmur, the treatment was used very cautiously for the first few times, 0·2 to 0·4 inch depression being used only at first, with iodine and pine-extract spray; later the pressure was increased to 0·8 and to 1 inch without the least difficulty three times a week, the patient being obliged to take a long journey in the horse-cars from her home each time.

After seven treatments the patient felt very much better. The cough diminished, appetite improved, and the general strength increased, so that the journey, which caused great fatigue at first, was borne quite comfortably.

August 6th.—One month after first visit physical examination showed a marked diminution in the number of coarse râles on both sides, the finer râles still persisting. General condition much improved; patient much stronger, although a loss of two pounds of flesh was noticed. Temperature 100°, pulse 110.

September 21st.—Still marked improvement, although a loss of four pounds of flesh was noticed since first visit. Dr. Greene wrote: "I do not see how the changes in her physical signs can be interpreted otherwise than very favorably. I remark now but very slight signs of irritation in the left lung, where such signs were plentiful when you began treatment. In that respect the improvement is very remarkable, and it corresponds to an almost complete disappearance of febrile temperature. . . . I observe she has lost weight, but her looks show improved health, and she says she feels very well."

December 15th.—Improvement continues. Has gained six pounds

since September 21st. Once or twice has expectorated small quantities of blood.

February 25th.—Continued coming in town all winter to the cabinet, and, with the exception of a temporary gastric disturbance for a week or ten days, and occasional spitting of blood, has felt nicely. Occasional examinations of the chest revealed no marked change in the physical signs, except the disappearance of the prominence of the right clavicle. The morning and evening temperature, as shown by a chart during this time, was almost always normal, only a slight rise being occasionally noticed. Late in the afternoon of this date patient had a slight hæmorrhage, and two days later another. Did not come in for treatment from this time until April 10th, on account of three or four slight hæmorrhages. Lost three pounds in weight, and cough increased. Examination of chest showed again no marked change, except the "crumpling" noticed before in left back extended possibly a little farther down.

Since April 10th the patient has resumed treatment, and notices the beneficial effect of it again in increased strength. The only tonic medicines given were at first bovinine, and afterward Fellows's hypophosphites; but during the winter for nearly a month was taking no medicine at all. Is now taking tincture of chloride of iron.

Examinations for bacilli in the sputa at various times revealed very few, or none at all.

Iodine, with pine extract, was used for inhaling for the first two months; later, for three months, phenyl, and from December 29th to February 25th camphor-water and creasote ($\overline{3}$ j–gtt. x). Lately only camphor-water has been used.

Synopsis of Case.—Chronic tuberculosis of both lungs of several years' standing.

Result.—Very marked improvement for six months. Increase of symptoms upon omitting treatment for a month. Improvement with renewal of treatment up to present time.

Case V was one of incipient phthisis, with a sharp attack of bronchitis, in a poor woman living in a dispensary district. Bacilli in small quantities were found in sputa. Patient only took four treatments, and then ceased to come. Four months later was seen, and the disease had evidently advanced rapidly. No effect was noticed in the four treatments given with iodine and pine extract.

Case VI.—June 9, 1885. Mrs. B., aged twenty-seven. Advised by Dr. H. I. Bowditch to try the cabinet as a last resort. Family history excellent. The personal history was the usual one of phthisis, dating back eight or ten years, with slowly increasing symptoms. Loss of voice for five or six months previous to first visit. Night-sweats, harassing cough, copious sputa (occasionally bloody), and dyspnœa were the chief symptoms complained of.

Physical Examination.—Pale, pinched face. Emaciation. Increased vocal fremitus at right apex. Decided dullness in upper right. Reso-

nance less than normal in upper left. Prolonged expiration at upper right, rather bronchial respiration, and bronchophony with "crumpling," and an occasional sonorous râle throughout right chest. In upper part of left a "crumple" after cough and full inspiration, with occasional sonorous râle. In the back about the same. Pulse 114, temperature 99·6°.

Diagnosis.—Advanced phthisis, probably tubercular. Prognosis very bad.

Fusel-oil (gtt. v, t. i. d.) was ordered.

After the third treatment in the cabinet there was "decided improvement in breathing." After the tenth treatment (three weeks later) patient felt much stronger and better generally, and one month after first visit both the patient and her husband noticed marked increase in strength, improvement in appetite, less cough and expectoration, less fatigue in talking.

September 24th.—Examination showed the dullness at the right apex to be less marked than before, and the whole character of the respiration on this side was drier and freer than before. From this time on the patient continued to come into town from Wellesley Hills, about twelve miles from the city, and was always convinced of the beneficial effect of the cabinet in relieving her of any sense of oppression in the chest. Her strength gradually failed, however, and about the middle of January she suffered severely from sore throat, and the inability to swallow food caused rapid loss of flesh and strength. One inhalation of camphor and creasote gave great relief, and there has been no return of the sore throat since that time.

About February 1st the patient suddenly was able to speak aloud, and not in a whisper as before, although still hoarse. No special change noticed in the larynx. The last physical examination was made February 24th. Percussion revealed nothing new. The respiration in the right apex down to the second rib was harsh, bronchial, and dry, with scarcely any râle. Bronchophony. Below this an occasional dry "click" was noticed. In the left apex a dry "crumple" was heard, rather increased after cough. In both apices behind the same signs, but less marked than in front, were noticed—all of which seemed to indicate a less active process going on in the lungs. The temperature chart during January and February showed a less febrile condition than before. Both my father and I felt pleased with the result when considering the condition of the patient nine months previously. Soon after this the patient's strength failed rapidly, the cough and expectoration increased, and at last accounts she was unable to leave her bed. The patient had about sixty-five sittings up to March 17th, which was the last time she was able to come. Iodine with pine extract, phenyl, camphor with creasote, were the inhalations chiefly used. Examination of the sputa at different times showed the presence of bacilli in varying quantities, from none at all to many.

Synopsis of Case.—Chronic tubercular disease of both lungs of many years' standing, in the last stages. Treatment given sixty-five times.

Result.—Great alleviation of most distressing symptoms for nine or ten months.

Case VII.—July 11, 1885. Mrs. M., aged twenty-eight; dispensary case; married four months; family history generally good; great-grandfather died of consumption.

About six weeks before first visit began to cough after severe hoarseness; yellow, copious sputa; no blood; pain between shoulder-blades; vomiting; no special fever; night-sweats; anorexia; bowels regular; menses regular; sleep destroyed by harassing cough; much loss of flesh and strength; feels very miserable.

Physical Examination.—Patient does not look ill, but tired. Increased vocal fremitus in right apex. No dullness in front or back.

Auscultation reveals "crumpling" down to second or third rib in right apex; voice a little nearer. In upper right back, just above spine of scapula, expiratory murmur prolonged; a little tubular in character. No râle. Pulse, 94; temperature, 99·2°.

Examination of sputa reveals numerous bacilli.

Diagnosis.—Acute pulmonary tuberculosis with general bronchitis. Prognosis grave.

July 1st.—Sonorous râles were heard in both lower backs, and percussion-note in right apex behind was slightly higher in pitch.

Patient took twelve sittings in two weeks and a half. After the first she "slept better than for three weeks previously," and at the end of the week felt much better. Had severe fits of coughing at times, however, and sputa became bloody. After July 30th (two and a half weeks from first visit) the patient did not come again, and three days after the last treatment, after violent coughing, expectorated a large quantity of blood. Great weakness followed. Later the patient moved from town, and is now in a home with marked signs of phthisis, although stronger again.

Patient tried cod-liver oil, bovinine, and quinine at different times.

Synopsis of Case.—Acute tubercular disease of right lung.

Result.—Slight temporary benefit from twelve sittings.

Case VIII.—July 16, 1885. Mr. N., aged twenty-five, grocer. (Transferred to me by Dr. H. I. Bowditch.) Family history perfectly good; personal history, usually well and strong until the middle of May, 1884 (fifteen months ago), when he had two or three heavy colds with cough in succession. At the end of two weeks had a chill with fever; worked until June 16, 1884, when a very slight hæmorrhage from the lungs occurred. Was in Florida from October, 1884, until the May following. Cough was benefited, but patient acquired dysentery and malarial fever, and has had more or less diarrhœa since. No real pain in chest, but at times a "crumpling feeling" in left chest. Night-sweats; loss of flesh and strength; dyspnœa at times; occasional chills; no marked feverishness; appetite poor; vomits occasionally; more or less diarrhœa; no

trouble with water; has done no work for a year; chief complaint is of cough, diarrhœa, and general weakness.

Physical Examination.—Decided emaciation of face and body; languid manner; slightly increased vocal fremitus in right apex.

Percussion-note slightly dull and inelastic in right apex and in right back; somewhat high in pitch. Auscultation reveals an indistinct "crumple" in right apex, although vesicular murmur can be heard also. Signs more marked toward the lower part and in axillary region. On the left front, about the second or third rib, murmur vesicular, and once or twice a "click" heard. In both lower backs and in the upper right a squeaking sound with inspiration. No marked bronchophony, but voice sounds nearer in right apex in front. Temperature, 100·3°; pulse, 120; expansion of chest, 30 to 31½ inches. Sputa examined once for bacilli and none were found.

Diagnosis.—Phthisis, probably tubercular. Prognosis bad.

The patient lived forty miles out of Boston, and was obliged to take a fatiguing carriage and railroad trip three times a week.

Five sittings, with iodine and pine-extract inhalations, were given in the cabinet from July 16th to August 1st, and for a week I saw nothing of him, and I supposed the treatment was not satisfactory, as he seemed to think the cough had increased, and he complained of fullness in the head. On August 1st he appeared looking much better, and expressing himself as much encouraged. Since the last visit had coughed and raised very much less, and the diarrhœa ceased. A sharp pain near the left nipple prevented him from making the journey for a week, but, apart from this, patient felt much better. Examination of the chest showed a distinct friction-sound near the left nipple, but the sonorous râles noticed before in both backs had entirely disappeared. Temperature, 99·2°; pulse, 100.

From August 1st to August 24th the patient appeared only three times, and wrote that after visit on August 6th he had a chill and fever with increased cough, "which was always the case when malarial attacks appeared." On the 19th the diarrhœa had begun again with consequent prostration.

August 24th.—A one-grain opium pill was ordered, and as a tonic a mixture of Fowler's solution and Fellows's syrup of hypophosphites in the proportion of three drops to one teaspoonful.

September 21st.—The patient wrote that he had been in the White Mountains and had improved wonderfully. Gain of strength and flesh. No chills nor bowel disturbance since he began the medicine.

25th.—Returned, feeling nicely. Cough about the same, but expectorates freely. No pain in chest. No diarrhœa. Examination of chest showed a slight "crumpling" near left nipple, and in the lower right back slight dullness, and respiration rather fainter here than on left. Otherwise, signs about as before. Power of expansion about the same.

28th.—Patient came saying that since the last treatment he had had

almost constant headache, dizziness, vomiting, loss of appetite, and once a slight return of diarrhœa. I ordered the medicines discontinued, and since then have not seen the patient; but on October 6th he wrote that his friends wished him to go to Colorado, although I advised his coming nearer to Boston in order to take the treatment more regularly without the fatigue of a long journey.

Patient took ten treatments at irregular intervals, with iodine and pine extract for inhalation at every sitting except the last, when phenyl was used.

Synopsis of Case.—Phthisis, probably tubercular. Seat of disease: right lung chiefly and a circumscribed space in left. Complications: attacks of chills, followed by fever of probable malarial origin. Diarrhœa.

Result.—Marked benefit at first under unfavorable conditions for treatment, although fullness of head after treatment was complained of often. At the last sitting, questionable injurious effect of treatment, which was given ten times in two months and a half.

Case IX.—July 18, 1885. Mr. M., aged eighteen, clerk. (Transferred to me by Dr. H. I. Bowditch.) Family history excellent. Personal history: always well until September, 1884, when he had a slight cough, with yellowish sputa once or twice, slightly streaked with blood, for about a month, when the cough ceased. Was well all winter. About the middle of April cough began again and grew steadily worse. No special pain except occasionally in lower part of left chest at night; dyspnœa; loss of flesh (seventeen pounds) and strength; yellowish sputa; appetite fair; occasional distress from food; bowels not quite regular; loss of sleep from coughing; no marked fever.

Physical Examination.—Face and body rather emaciated; no special dullness in front or back; possibly the percussion-note is a little higher in upper left chest. Auscultation reveals an explosion of rather fine râles above and below both clavicles down to about second or third rib; no bronchophony; sibilant râles in both backs toward the top. Respiration pure below, although rather exaggerated. Pulse, 118; temperature, 101·4°; expansion of chest, 29 to 29⅞ inches.

Diagnosis.—Phthisis; apices of both lungs affected.

Patient was advised to leave his home, a sea shore town, and came to Wellesley Hills, near Boston; treatment was given three times a week, using iodine with pine-extract inhalation and Churchill's hypophosphites internally. The improvement in this case was wonderful. After the first treatment the cough lessened. In three weeks he had gained seven pounds; could take a long walk without the least fatigue, slept soundly all night, and looked so much better that a friend who had not seen him for three weeks was amazed at his great improvement.

August 22d.—After eighteen or nineteen treatments he had gained eleven pounds. The expansion of the chest had increased from seven eighths of an inch to an inch and a quarter; chest looked fuller and

rounder; patient held himself more erect. Temperature was 99·3°; pulse 114.

September 3d.—He had gained seventeen pounds and weighed as much as he ever had before. At this time there was scarcely any cough or sputa.

23d.—No cough at all. Slight clearing of throat two or three times a day. No sputa whatever. Feels perfectly well. From the general aspect of the patient and from his account of himself, he could have been called perfectly well at this time, but several examinations at different times showed a persistence of the abnormal sounds in both lungs, and I therefore recommended his not returning home. In November there was a slight return of cough and sputa and a slight decrease in weight. Rather against my better judgment, the patient returned at the end of November to his home, where he was detained by severe weather about two weeks, and he returned looking not nearly so well, the cough and sputa having increased again. Treatment was resumed, the patient having moved to the city, and daily horseback exercise was ordered. Improvement immediately followed. The cough lessened. Up to the present time the patient has been taking treatment six days a week, and, although not so well as last summer, is much stronger than when he first returned to Boston, and has endured a very cold winter remarkably well. The temperature chart showed a decided rise in the evening during December and January, but lately has not been so high, and at one time in January slight night-sweats appeared for a short time. In March a slight pleuritic friction-sound was heard in lower right axillary region, only lasting a day or two. Sputa has been at various times slightly bloody.

Examination now reveals possible lack of elasticity in both apices. The râles noticed in apices at first examination persist, and on left chest extend possibly a little farther down. Occasional sonorous râles in lower portions of chest on each side. No bronchophony, but expiratory murmur is more marked in upper right, and voice is nearer in this region.

Churchill's hypophosphites were given for three or four months, later the compound tincture of cinchona, and about two months ago Scott's emulsion of cod-liver oil. For night-sweats, zinc and belladonna pill or aromatic sulphuric acid. Examination of sputa for bacilli at various times has shown varying quantities from none at all to a moderate number, the last two examinations showing very few.

Synopsis of Case.—Tuberculosis of both lungs. Two hundred sittings given since July 18, 1885.

Result.—Very great improvement, and cessation of nearly all morbid signs for several months. Renewal of symptoms after omitting treatment and upon returning to sea-shore climate. Subsequent improvement upon resuming treatment, which is still continued. General condition very much better than when he began. Termination doubtful.

Case X.—September 15, 1885. Mr. N., aged forty (?). (Case sent me by Dr. M. H. Richardson.) Empyema of several years' duration; a per-

manent opening had been made in left side many months before, and in the spring of 1885 three or four ribs had been resected in the left side with the hope of reducing the large cavity, and treatment with the cabinet was recommended in order to forcibly expand if possible the lung bound down by old adhesions. At this time respiration could not be heard at all below the spine of the left scapula. Treatment was begun three or four months after the operation, the patient coming three times a week, and at the end of six weeks the respiratory murmur could be heard by Dr. Richardson, Dr. H. I. Bowditch, and myself much more plainly in the lower left back than on the previous examination, and, although the discharge from the cavity was about the same, Dr. Richardson pronounced the cavity itself smaller. The patient felt much stronger and was desirous of keeping up the treatment, which was continued until March 12th, and at this time a very faint respiratory murmur could be heard one inch below angle of left scapula.

Treatment was not continued after this, as it was thought wiser to perform another operation later.

Synopsis of Case.—Long-standing empyema; lung held down by old adhesions.

Result.—Expansion of lung increased by use of cabinet; treatment given about four months three times a week.

Case XI.—July 29, 1885. Dispensary case. Miss W., aged thirty-seven, tailoress. Family history: *four* brothers died of consumption; father died of heart disease; mother, disease of liver. Personal history: delicate when young, but since fifteen has been well. During the winter previous to first visit had a cough for two months which entirely disappeared, but reappeared June 17th after taking cold. Grew rapidly weak, unable to walk. Cough harassing, causing loss of sleep. Sputa whitish, occasionally streaked with blood; copious. No pain nor night-sweats; feverish and chilly; dyspnœa after talking or exercise; much loss of flesh (twenty-one pounds); menses rather too frequent. Chief complaint was of cough, and loss of sleep and weakness.

Physical Examination.—Pale, looks tired and languid; slightly increased fremitus to hand in right apex. In right apex in front, slight dullness; in back in left apex, note higher pitched, slightly dull. Auscultation reveals sonorous râles throughout both chests, lasting through inspiration and expiration, front and back, but more marked in the upper left back. Just above spine of left scapula, through the sonorous râles a "crumpling" heard, and voice in this circumscribed space has a bronchial character. Temperature, 99·5°; pulse, 100; expansion of chest, 28½ to 29½ inches.

Diagnosis.—Acute bronchitis; incipient phthisis (?).

Treatment with iodine and pine extract for inhalation and iron internally was begun, and the patient still comes three or four times a week to the cabinet. The relief from the first treatment was very great, as she slept all night without coughing. She remained in St.

Luke's Convalescent Home about two months, then resumed her wor and has been able to work up to the present time while taking the treatment.

The sonorous râles in both chests entirely disappeared in October (three months later), but the finer râles noticed before in the left chest, front and back, persisted, although the patient's general condition had greatly improved.

January 15, 1886.—Careful examination revealed no râle anywhere in chest, and the spot of bronchial breathing near the spine of the left scapula was replaced by pure vesicular sound, although rather more obscure than on the right side, and the voice sounded a little nearer at this point. The cough at this time amounted to almost nothing, and the patient gained in weight and looked quite rosy, and from this time to February 3d (two weeks) she declared she did not cough once.

Later a slight pleuritic pain in left side was complained of, and a very small spot in lower left axillary region was found where very fine râles could be heard after cough.

Patient has not been feeling quite so well of late, but keeps at work, coughs, and raises very little.

The last examination reveals free respiration in both sides in front of chest, although there is a suspicion of a "crumpling" heard in left apex; no dullness.

In left back near spine of scapula faint but distinct "crumple" heard also above and below this point. In right apex one or two medium râles heard.

The patient has taken at different times tonics of iron, Fellows's hypophosphites, cinchona, and has had about 160 sittings in the cabinet.

Repeated examinations of the sputa reveal varying quantities of bacilli from a good many to none, the number usually corresponding to the condition of the patient, being more numerous when the trouble seemed more active. The patient expectorated blood several times, and on April 15th raised about a quarter of a tumblerful. The temperature chart shows scarcely any rise above normal in the last two months until the last week, when it has once or twice reached 100·5°.

Synopsis of Case.—Severe bronchitis supervening in the course of tuberculosis of the left lung. Very great improvement after many discouraging symptoms, with almost complete disappearance of all morbid signs for a short period, six months after treatment was begun. Slight renewal of symptoms later. Patient still continuing treatment. Termination doubtful.

Case XII.—August 12, 1885. (Sent me by Dr. F. M. Welles, of Chelsea.) Mr. D., aged twenty. This gentleman had a phthisical history, with occasional hæmoptysis for several months, the disease being far advanced when I first saw him. Excessive cough, copious sputa, great dyspnœa upon exertion, pains in the lower left chest, loss of flesh and strength

lack of sleep from cough, and occasional epistaxis, were the chief symptoms complained of.

Physical Examination.—Inspection shows much freer movement of right side than of left during respiration. Palpation shows slightly increased fremitus in upper part of left chest. Slightly higher pitch in left chest, and in left axillary region, about eighth rib, dullness, increasing downward to flatness, noticed. In back, flatness from one inch below spine of scapula. Auscultation revealed a "crumple" throughout left front. Absence of respiration in extreme lower part. No bronchial respiration nor bronchophony. In back, "crumpling" in upper left; absence of respiration in region of flatness. Heart in normal position. Temperature 100·4°, pulse 94. Sputa contained numerous bacilli.

Patient took twenty-nine treatments from August 12th to September 25th, and was at the time a most discouraging case, for, although the first treatment was followed by a perfect night's sleep, the first in many weeks, the patient coughed badly in the cabinet, complained of great pain in left side, excessive expectoration, vomiting, epistaxis, and seemed to be getting no benefit at all. Finally, on the 21st of September, he discontinued the treatment, and I considered it an unsuccessful case. Three months later Dr. Welles wrote me that, immediately after stopping the treatment, a very marked improvement showed itself; the cough ceased almost entirely; the sputa became thin, like mucus; the night-sweats ceased; the patient gained nine pounds in weight; he had no pain in the chest; and whereas he had been unable to go up two steps without taking breath previous to beginning the treatment, he could run up two flights without stopping; the appetite became voracious, and his general strength vastly improved. The expansion of the chest showed an increase of one inch and a quarter, and his friends, who had been most anxious to have him stop the treatment before, were now greatly pleased with it. It is reasonable to suppose that the pain arose largely from the forced expansion of the lung clogged with secretions, the removal of which and the subsequent absence of fatigue from the exercise of the cabinet caused the improvement in the general symptoms.

December 23d.—Three months after the last treatment, examination showed marked improvement in the general aspect. Much less difference in the movement of the sides. The flatness in the lower left chest had disappeared, but evidences of consolidation of the upper lobe of the left lung were present—viz., dullness, bronchial breathing, with fine dry râles, and bronchophony in the upper left chest. The patient had three or four more sittings, but, about a month ago, Dr. Welles wrote that the symptoms were increasing again, and that the patient's strength was rapidly failing. Iodine with pine extract, and corrosive-sublimate solution, 1 to 2,000, with carbolic acid, 1 to 200, were used in spray in this case. Cod-liver oil and quinine used as a tonic.

Synopsis of Case.—Advanced tubercular disease of left lung, with

slight pleuritic effusion. Twenty-nine sittings in a period of about six weeks were used, in spite of very discouraging symptoms.

Result.—No benefit during treatment apparently, but immediately afterward remarkable improvement in general symptoms, lasting three or four months, with great comfort to the patient. Subsequent renewal of symptoms.

Case XIII.—August 19, 1885. Miss C., aged forty-four. No history of lung trouble in family. Patient has a history of phthisis for twenty years. Chief complaint is of cough and expectoration of copious dark-green, purulent, offensive matter. Unable to lie down long, owing to choking sensation from constant secretion. Before beginning treatment was feeling rather weak. Examination showed dullness and high-pitched note in upper left chest. Loud bubbling râles throughout the left chest, most marked at top. No râles in right chest detected. Temperature 99·2°, pulse 92.

After a month's treatment three times a week, using phenyl as a spray, the cough lessened, and the sputum, which was formerly offensive, lost its odor and was much less copious, the patient declaring that "she raised in twenty-four hours what she used to in two." Could lie down at night without feeling choked, etc.; general strength improved.

December 28th.—The patient had gained six pounds and a half in weight, and her favorable symptoms continued, although not always feeling equally comfortable. Was troubled with vertigo during the winter a good deal, which was explained by some aural difficulty, and did not seem to be connected with the use of the cabinet. Lately has not been feeling so well again, and has not come so regularly for treatment, although always asserting that it has been of great benefit to her. Repeated examinations of the sputa show an entire absence of bacilli in this case. The compound tincture of cinchona, Murdock's liquid food, and the tincture of chloride of iron are the only medicines which have been used in this case.

Synopsis of Case.—Chronic non-tubercular phthisis of left lung of twenty years' standing.

Result.—Marked amelioration of some of the most distressing symptoms.

Case XIV.—September, 1885. Miss S., aged twenty-one. Patient in Hospital of Good Samaritan.

Mother died of consumption, and one brother ill with same disease.

This case was one of marked signs of phthisis of nine or ten months' standing in both lungs. The patient did not come very regularly, but had forty-seven sittings between September and the middle of December without material benefit, except an improvement in the shortness of breath and a slight increase in strength. At one time gained three pounds and a half, possibly attributable alone to cod-liver oil which she was then taking. A single examination of the sputa failed to reveal the presence of bacilli, but I think, from the character of the case, they would have been

found later. As I was unable to have full control of the case, I discouraged her coming for further treatment.

Synopsis of Case.—Well-advanced disease (probably tubercular) of both lungs. Very slight relief from excessive dyspnœa by the use of the cabinet; otherwise little benefit noticed.

Case XV.—September 25, 1885. Mrs. E. (sent me by Dr. W. E. Smith, of Framingham, Mass.), aged forty, widow. No history of pulmonary disease except the maternal grandmother and grandfather, and one aunt, who died of consumption.

Personal History.—Usually strong, but subject to severe cough for years. Fifteen years previous was thought to be in consumption, but "recovered entirely." Five years ago had what seemed like whooping-cough. Six months later had a hæmorrhage (slight), and occasional slight ones since. Bloody sputa at times during the year previous to first visit. For ten months had not been free from cough, with mucopurulent sputa. Lost eighteen pounds of flesh and much strength; more or less dyspnœa; pain not noticed; variable appetite; digestion normal; menses regular; inability to lie on left side owing to cough; chief complaint was of harassing cough and consequent loss of sleep; dyspnœa upon the least exertion, and lack of strength; had tried every kind of medication in the six months previous to first visit without the least benefit, and was thoroughly discouraged.

Physical Examination.—Patient rather thin and spare, but not looking very ill. Ribs prominent, but no marked emaciation. Increased vocal fremitus in left apex, front and back. Percussion shows resonance less than normal in both apices, and slight dullness at the upper left. In back, throughout the left side, dull compared with right.

Auscultation revealed "crumpling" heard in upper part of right and left chest. No special difference in voice. In back, "crumpling" throughout left; very marked at base. No vesicular breathing throughout left. In upper half of right back a "crumple" heard. In base, respiration free. In lower right back, where respiration is free, the voice is very distant, although no dullness there. No bronchophony. Temperature 99·3°; expansion of chest, 28–30¼ inches. Examination of sputa shows presence of numerous bacilli.

Diagnosis.—Tubercular disease of both lungs. Prognosis bad.

After five treatments, the patient declared that she felt much stronger in spite of the journey in the cars from her home twenty miles distant. From this time on, although the patient spoke of increased strength and of ability to lie on left side, which she had not been able to do for six months, the case was a most discouraging one to treat, from the constant interruptions owing to bad weather, to the presence of a spasmodic cough, and muscular rheumatism, which were always aggravated by cold weather. The patient, however, was so pleased with her gain in strength that she desired to keep on.

November 15th.—About eight weeks after first visit, Dr. Smith wrote

that patient was able to walk better than for months, and that there had been a gain of about three pounds and a half in weight; increase of about half an inch in power of chest expansion.

30th.—In spite of adverse circumstances, examination showed a better percussion-note in both apices, and the respiration was freer than before, although not purely vesicular, and at end of inspiration a "crumple" was heard. Elsewhere the signs were about the same, except that the voice, in lower right back, was no longer distant to the ear as before. The same date Dr. Smith wrote of his surprise at the improvement in the physical signs, and remarked: "This is positively the first time since last April that I could say, in judging by the physical signs, there was the slightest improvement in her case."

The temperature chart from November 21st to December 10th showed a normal condition.

January 4th, 1886.—In spite of spasmodic cough and rheumatism previously, the patient reported at this date scarcely any cough or sputa. A gain in weight of four pounds and three quarters since first visit. Ability to sleep well all night. Much encouraged.

From this date to February 9th, with the exception of a heavy cold taken when trying the experiment of living in town for a few weeks, patient was feeling much better.

February 9th.—Felt rather tired before and after treatment, but went shopping, went home in damp clothes, and in the middle of the night woke with blood in her mouth and a severe pain in lower part of right chest; felt very ill. Dr. Smith was called and detected no increase in the signs in the chest until the next day, when marked symptoms of an acute pneumonia in the lower lobe of the right lung appeared, as corroborated by Dr. Adams, of Framingham, and on February 13th the patient died. Forty-five sittings were used from September 25th to February 9th. The only medicine given internally was the compound tincture of cinchona for a short time.

Phenyle, iodine with pine extract, and creasote with camphor-water, were chiefly used for inhalation.

Synopsis of Case.—Chronic tubercular disease of both lungs. Forty-five sittings given in a period of four months and a half.

Result.—In spite of most discouraging symptoms, in addition to spasmodic cough and muscular rheumatism, marked improvement in many symptoms for several months up to time of onset of acute pneumonia, which terminated in the death of the patient in four days.

Case XVI.—October 1, 1885. Miss W., aged sixteen.

Patient was a delicate girl, subject every winter to constant severe colds and coughs. Treatment was tried with the cabinet chiefly, in order to expand the chest. Patient complaining of severe coryza and oppression in chest. No dullness or râles detected in chest.

Diagnosis.—Subacute bronchitis and coryza.

Between October 1st and 12th six treatments were given. After first

treatment the oppression in chest was entirely relieved, and the mother remarked at the end of treatment "that it was remarkable there had been no cough with this cold, which had always been the case before."

As the patient took the syrup of hydriodic acid as well, I can not attribute the entire benefit to the use of the cabinet, of course, but merely state it as a fact that the young girl has been almost entirely free from the heavy colds and coughs from which she has suffered for several years in the winter time.

Synopsis of Case.—Subacute bronchitis.

Relief of oppression in chest after one treatment.

Case XVII.—October 8th. Mrs. C., actress.

Patient suffering from advanced disease of left lung, and had received marked benefit from the use of the cabinet in New York when under Dr. Williams's care.

Patient took treatment October 8th and 9th, and November 3d, 4th, 5th, and 6th, with much comfort to herself, and then was obliged to leave the city.

No examination for bacilli was made.

The patient appeared again May 3, 1886, saying that she had been traveling throughout New England and New York State all winter, and her cough was much better, although her strength was not so great and her appetite was poor. Convinced, however, of the benefit of the treatment, she returned to Boston for a week for the purpose of trying the cabinet again.

Synopsis of Case.—Phthisis, probably tubercular, of three years' standing.

Amelioration of symptoms; patient returning at various times for treatment.

Case XVIII.—October 20, 1885. (Sent me by Dr. F. H. Hooper, of Boston.) Mr. C., aged thirty-one, single; drawing-teacher.

Family History.—Father living and well. Mother has always had delicate lungs and throat, and grandfather died of consumption. Patient never robust, but usually well.

About four years previous to first visit, when at the mountains, first noticed a curious wheezing noise in throat. Sore throat afterward. Since that time had cough with occasional intermissions. Sputa more or less copious; obliged to wake at night to clear throat. Once, about three weeks before first visit, sputa tinged with blood; none of these symptoms were very troublesome, and otherwise the patient complained of nothing abnormal and felt very well, but wished, if possible, to rid himself of the cough, fearing something more serious. Had been under Dr. Hooper's care for laryngeal trouble, which had improved, but, as the other trouble did not yield to various remedies, Dr. Hooper wished him to try the cabinet.

The patient looked perfectly well, with the exception of slight sallowness of complexion. Chest full, well formed.

Percussion-note revealed good resonance everywhere, possibly a little exaggerated. In the right apex behind, a little less elastic and higher pitched than on left, but not very pronounced.

Auscultation reveals in both chests in front at the end of expiration a wheezing sound, which seems more marked after cough; occasionally heard with inspiration also. Respiration more marked in apices than in the lower part of back, where it is rather indistinct. Râles not so noticeable behind as in front. No bronchial breathing nor bronchophony anywhere.

Pulse, 78; temperature, 99·3°; expansion of chest, 33½–35½ inches.

Diagnosis.—Chronic bronchitis. Prognosis favorable. Examination of sputa revealed no bacilli.

Between October 20th and December 25th the patient took about fifty-five sittings, using chiefly iodine with pine extract and a small amount of bicarbonate of sodium as a spray. At other times a solution of resorcin, with borax and phenyl. Several examinations of the chest revealed no special change in the signs, except that once or twice there seemed to be fewer râles. The cough and amount of sputa continued about the same, and the general condition about the same—that is, comparatively well.

As no special benefit was noticed from the use of the cabinet, a permanent change of climate was advised.

About the middle of January the patient came back complaining of a curious sensation in the lower right chest; a stuffed feeling, "as if he missed the cabinet." Examination showed the respiration to be freer than at any previous time, but the slight cough and sputa continued.

Soon after this the patient went to Florida. The only medicines used were Fellows's hypophosphites, and afterward, at the patient's request, Ayer's cherry pectoral; 0·6 to 0·8 inch depression of the barometer were used in this case.

Synopsis of Case.—Chronic bronchitis. Fifty-five sittings given.

Result.—No benefit from the use of cabinet. Change of climate recommended.

Case XIX.—Mr. F., aged nineteen. October 24, 1885. Severe acute bronchitis of two or three days' duration. Cough and wheezing; oppression on chest. No dullness anywhere, but sonorous and sibilant râles were abundant throughout chest. Four treatments were given. After the first, with phenyl as a spray, the cough and oppression were much relieved. After the last treatment (four days later), the examination of chest revealed only slight roughness of respiration, and two faint sonorous râles. The cough had disappeared. Five days later the patient said he felt better than for two or three months previous to the attack. Examination showed pure respiratory murmur throughout chest.

Synopsis of Case.—Acute bronchitis. Relief to cough and sense of oppression after one treatment. Cessation of cough after fourth treatment. Phenyl and resorcin with borax used, each twice.

Case XX.—Mr. Q., aged twenty-nine. November 3, 1885. Chronic bronchitis. Patient only came once, and took very short treatment. Not willing to take the journey from his home, therefore nothing further was done.

Case XXI.—November 19, 1885. Mrs. S., patient in Channing Home. Advanced tubercular disease of both lungs, with harassing cough and severe oppression of chest. Numerous bacilli in sputa. Treatment was given as an experiment to try and relieve the oppression of the chest. The patient came ten times between November 19th and December 11th, and experienced marked relief from the oppression and tickling in throat. Could expectorate more freely. Bad weather and weakness from excessive diarrhœa prevented further treatment.

Synopsis of Case.—Advanced pulmonary tuberculosis. In ten treatments, marked relief from some of the symptoms.

Case XXII.—December 12, 1885. Mr. H., aged twenty-nine. Family history shows no phthisical tendency. Patient gave phthisical history of about two years' duration. Evidences of well-advanced tubercular trouble throughout right lung, marked by dullness, non-vesicular respiration, with marked "crumpling" throughout that side. Nearness of voice in right apex in front and behind. Repeated examinations of sputa showed presence of numerous bacilli. Pulse rather rapid. Continued elevation of evening temperature, as shown by chart.

The patient had been given up by physicians, and, as he wished to try the treatment, it has been given him up to May 1st, either three or six times a week, with occasional interruptions, and, although a variety of inhalations have been used, I can not say that the least benefit has been obtained from the use of the cabinet, with the exception of an improvement in the shortness of breath during the first month.

Synopsis of Case.—Well-advanced tubercular disease of right lung. No appreciable benefit from treatment of about three months' duration.

Case XXIII.—February 10, 1886. Miss B., aged fifty-five. (Sent to me by Dr. Elbridge G. Cutler.) In father's family there was a tendency to lung trouble, but none on the mother's side. Patient subject to coughs and colds all her life. For eight years since the menopause has suffered with constant harassing cough, with copious yellow expectoration. General strength fairly good, and no marked loss of flesh. No fever. Never has asthmatic attacks. Chief complaint is of constant cough and sense of stricture across the lower part of the chest. Has tried every kind of medicine and every form of inhalation, with nothing but temporary relief in some cases, and Dr. Cutler wished her to try the cabinet.

Examinations of the sputa revealed no bacilli. Percussion of chest shows possible slight dullness at the right apex, but not marked. In lower backs a slight increase in pulmonary resonance and deep tone.

Auscultation reveals numerous sonorous and sibilant râles throughout. At the right apex, front and back, the râles are more numerous and of medium quality. Heart-sounds are normal.

Diagnosis.—Chronic bronchitis, with slight emphysema.

Prognosis.—Unfavorable for permanent cure.

For the first three weeks treatment was given six times a week, using camphor-water and creasote (℥ j–gtt. x) as an inhalation. At the end of this time the action of the cabinet was reversed, the air within being compressed instead of rarefied; but at the end of a week the rarefied air was again used, and a steam atomizer, with a spray containing benzoin, was substituted for the cold-air spray. Treatment was then given three times a week up to April 17th, after which an inhalation of "terebene" was used, the terebene being poured upon a cloth which was tied over the end of the inhaling-tube. Fougera's Iceland-moss tablets were used at first, later Blancard's iron pills, then the syrup of hydriodic acid, and, finally, terebene internally has been given (two drops on a lump of sugar three times a day), and the patient is now using terebene in a small inhaling cylinder in her home.

Great benefit can not be claimed in this case from the use of the cabinet, and yet the patient feels that she can walk rather better, that the cough is not so incessant as before, and that the sputa are less solid and more easily expectorated. She, moreover, feels that the cabinet has enabled her not to remain housed all through March, when our climate is usually at its worst. The power of taking higher pressure while in the cabinet has increased, the patient now taking from 0·4 to 0·8 inch rarefaction, while at first 0·4 was managed with difficulty. The last examination shows a diminution in the number of sonorous râles, although râles of a less coarse character can be still heard, especially in the right back and in the right apex in front.

Synopsis of Case.—Severe chronic bronchitis of eight years' duration. Cabinet used as a last resort. Fifty sittings given. Slight improvement in some of the symptoms most complained of.

Case XXIV.—March 4, 1886. Miss M., aged eighteen. Mother and one sister subject to cough, but otherwise family history excellent. Patient had been under my care for about a year for general debility, following her removal from her home in the provinces to Boston. For ten months had suffered from amenorrhœa, and occasionally from violent attacks of gastralgia, which latter symptom improved by the use of hydrochloric acid. About one month before the beginning of treatment, when much debilitated and after exposure, was seized with severe cough, with copious yellowish sputa; hoarseness; pain across the chest; fever; loss of flesh and appetite. Inability to sleep on account of cough. General feeling of malaise and discomfort.

Patient pale, with exception of bright-red spots on cheeks.

Palpation and percussion revealed at first nothing remarkable.

Auscultation showed numerous sonorous and sibilant râles everywhere, front and back, especially on left. Temperature 100°, pulse 120.

Sputa contained a few bacilli.

Inhalation of camphor-water was given in the cabinet.

After the first sitting the patient slept with scarcely any cough all night, and after the second declared she "had not been able to breathe so well for six months." After the third the cough disappeared *completely*, although there was a slight amount of expectoration for a few days longer.

After the third sitting, three days after beginning treatment, examination of the chest revealed scarcely any sonorous râles even after cough. In the right apex in front, however, the percussion-note was slightly higher in pitch, a "crumple" could be heard with inspiration, and the voice sounded nearer. Hoarseness of voice still noticeable.

At the end of a week all expectoration ceased, and patient felt very much better. The compound tincture of cinchona was given for the appetite, and from this time on the patient steadily improved. From the fact that occasionally a sonorous râle could be faintly heard from time to time in the chest, and on account of the presence of the bacilli in the sputa, I advised continuing the treatment for four weeks, even though the "crumpling" noticed in the right apex soon disappeared.

On March 29th, about three weeks after beginning treatment, the menses, which had been absent ten months, appeared.

The patient moved out of the city, and on April 9th careful examination of the chest revealed perfect respiration everywhere, and the patient was feeling perfectly well.

The temperature, which had been rather elevated for the first three weeks, became normal, although the pulse remained rather rapid; the weight increased, the whole aspect was one of health, and the good account continues up to the present date.

Synopsis of Case.—Severe bronchitis, with incipient tuberculosis, as shown by presence of bacilli in sputa. Complete cure after eighteen sittings in four and a half weeks.

Case XXV.—March 25th. Miss B., aged thirty. This was a case of long-standing pleuritic effusion which had very slowly been absorbed, leaving the left chest-wall greatly retracted and the lung evidently drawn up toward the apex.

Treatment was tried as a means of relieving the patient from the inability to take a long breath with comfort and to see if the lung could be forced downward.

Treatment was given six times weekly for three weeks with marked benefit to the patient in her sensations. After the fourth treatment she was enabled to take a deep breath without a sense of constriction across the præcordium. Her power of walking improved steadily, and, although at first the treatment tired her a good deal, she noticed a marked improvement in her general symptoms.

The expansion of the lung was shown by increased resonance toward the lower back with very faint respiration, where formerly none could be heard, and, by the measurements of the chest, the left side showing an increase from 13¾ to 14¼ inches and the right side from 15½ to 16¼ inches.

Seventeen sittings were given, and from 0·2 to 0·7 inches rarefaction used.

Synopsis of Case.—Contraction of chest from slowly absorbing pleuritic effusion. Marked benefit from use of the cabinet. Seventeen sittings used.

Case XXVI.—April 15, 1886. Mr. H., aged eighteen. (Transferred to me by Dr. H. I. Bowditch.) This case is still under treatment, and I am as yet unable to state what the chances of permanent benefit are. A diagnosis of chronic bronchitis with asthma and slight emphysema was made at first from the presence of a tympanitic quality to the percussion-note throughout chest and back; sonorous râles, not very marked, heard in both apices without dullness or peculiarity of voice in any part of the chest, and from the presence of cough with copious sputa. The patient has been taking treatment for about two weeks, using chiefly a 1–2,000 solution of corrosive sublimate with from 0·4 to 0·5 of an inch rarefaction (that being the highest point yet reached), and the father reports improvement in strength, cough, sleep, and in the amount of the sputa.

The discovery of numerous bacilli in the sputa changes the character of the diagnosis, and it only remains for further treatment to show if still greater benefit will come from the use of the cabinet.

Synopsis of Case.—Chronic tubercular bronchitis of several years' duration. Improvement in certain symptoms in two weeks of treatment. Patient still using the cabinet.

Case XXVII.—April 20, 1886. Mrs. Q., aged twenty-seven. A case of severe cough with scanty sputa for about seven weeks; loss of flesh and strength; general debility; no marked fever; examination reveals slight dullness, with "crumpling" in lower left back and axillary region.

The case was one which could easily be considered the beginning of an acute phthisis. The examination of sputa twice shows no bacilli whatever; therefore I judge it to be a severe acute bronchitis. After the third treatment the patient declared herself feeling much better. The cough lessened, the soreness in left chest disappeared, and sleep improved.

Examination after the thirteenth treatment in two weeks showed a return of the normal respiration and percussion-note in the left back and axillary region, with the exception of one sonorous râle at that point. Cough scarcely noticed; appetite improved; gain of one pound in weight.

Synopsis of Case.—Severe bronchitis. Thirteen treatments given, with marked benefit after the third, and almost entire cessation of morbid signs after thirteenth treatment.

Paper.

THE PHYSICS AND PHYSIOLOGICAL ACTION OF PNEUMATIC DIFFERENTIATION.

By ISAAC HULL PLATT, M. D.

PNEUMATIC differentiation is the process by which the air surrounding the body and that entering the lungs are rendered of different pressures.

It may be considered under three forms, which, for the sake of convenience of reference, we will designate as positive, negative, and alternate differentiation. The first or positive differentiation is where the air entering the lungs is maintained during both respiratory acts at a greater pressure than that surrounding the body. Negative differentiation is the reverse of this, the air surrounding the body being maintained during both respiratory acts at a greater pressure than that entering the lungs, alternate differentiation being the process by which the two other forms are alternated during respiration; in inspiration the air entering the lungs being of the greater pressure, during expiration that surrounding the body being greater.

The apparatus introduced to the profession by Dr. Williams, and known as the pneumatic cabinet, is the only one, so far as I am informed, which enables us readily to apply to a patient any one of these three forms of treatment, and, as the clinical results reported by Dr. Williams and others are sufficiently encouraging to merit attention, it has seemed to me desirable that thought should be given to the subject of the physiological action of these forms of pneumatic treatment.

As the difference in pressure used is very slight, seldom exceeding that indicated by one inch of the mercury column, less than the fluctuation of the barometer from day to day, it is manifest that the actual pressure can be but an insignificant factor in the result, hence is of no importance whether the differentiation is accomplished by changing the pressure of the air breathed, or of that surrounding the body; the important fact being that they are rendered different. This will be referred to again farther on. The pneumatic cabinet acts by changing the pressure of the air about the body, the pressure of the respired air being that of the surrounding atmosphere.

The primary effects of the differential process will undoubtedly be expended upon the organs and functions of respiration and upon

the circulation. Let us first consider the effect of what we have agreed to call positive differentiation upon respiration. In normal respiration, owing to the elasticity of the lungs and of the chest-walls, expiration is a passive act—that is, if no force is voluntarily exerted upon the chest-walls, the thorax will assume the position of expiration. In other words, the passive position of the thorax is that of expiration. Inspiration implies an active exertion, and must be accomplished against a certain amount of resistance, one element of which is the pressure of the atmosphere upon the outside of the body. It is obvious, therefore, that, as a portion of this pressure is removed, the passive position of the thorax will approach nearer to that of inspiration. In normal respiration the amount of force exerted by the elasticity of the lungs in full inspiration, according to Foster, is equal to the pressure measured by 30 mm. of mercury. A rarefaction of this amount, then, will just balance the elasticity of the lungs, and allow the thorax to take such a position as the elasticity of the thoracic walls will determine. The effect of a comparative increase of the intra-thoracic pressure will be to distend the air-passages and alveoli of the lungs. If, then, an effort of inspiration is made, the distension of the lungs will exceed that which can be accomplished by the same effort without the aid of the differential pressure, and the expiratory effort will be obstructed to the same degree as the inspiratory effort is aided, consequently the stationary and residual air will be increased. In other words, the subject of the differential pressure will be suffering temporarily from a condition analogous to that of emphysema. This is opposed to what has heretofore been written, all the papers which I have seen upon the subject taking the ground that the residual air is diminished; but this is plainly impossible, as no more than the usual force can be brought to bear in expiration, while more than the usual resistance has to be overcome. This result can be easily confirmed by experiment. A number of persons were subjected to the differential pressure of half an inch, and it was found that the chest girth was, on an average, three eighths of an inch greater upon forced expiration than under normal circumstances. As the residual air is determined by the capacity of the chest in forced expiration, it is evident that, unless the diaphragm rides higher during the differential pressure, the residual air must be augmented. During expiration the diaphragm is a relaxed muscle or a passive membrane, acted upon solely by the pressure above and below it, but, by the conditions of our experiment, the pressure upon its lower surface is less than normal, while that upon its upper surface

remains the same; hence it will ride lower than under normal circumstances, and, so far from acting to offset the tendency to greater capacity of the chest caused by the greater chest girth during expiration, it will act to still further augment it, and still further increase the amount of residual air.

A further and, if possible, still more conclusive demonstration of the proposition is the following: A person is subjected to the positive differential pressure of half an inch, and is required to expire as forcibly as possible. The pressure is removed and he is requested to continue the effort of expiration. An additional amount of air is driven from the lungs, which may be conveyed, by means of a rubber tube, to a bell jar inverted over water and measured, and it is found to be equal to about forty cubic inches. This is the amount which the residual air is augmented by the positive differential pressure of half an inch.

The effect of this process upon the respiratory function, therefore, is that all parts of the lungs will be more fully distended, but less than the usual amount of contraction will be allowed, and the increased effort of expiration affords exercise to the muscles of expiration. Excessive or long-continued pressure will undoubtedly tend to cause permanent emphysema.

The effect of negative differentiation will be, in a great measure, the reverse of this. The passive position of the thorax will become one of expiration to a greater degree than is normal; the natural tendency of the lungs to contract by their own elasticity will be aided by the comparatively increased pressure upon the thoracic walls; expiration will be to a greater degree than normal a passive act; and, when aided by a forced respiratory effort, will be more fully accomplished than is possible under ordinary circumstances; hence the amount of the stationary and residual air will be reduced. Inspiration will be rendered more difficult, and can not be carried to the same extent as under normal conditions; the lungs will be contracted and the muscles of inspiration strengthened by exercise.

The effect of alternate differentiation will be a combination of the effects of the two former. Both respiratory acts will be aided or rendered passive, the residual air will be reduced to a minimum, the alveoli contracted to as great an extent as possible during expiration, and fully expanded during inspiration. The lungs will thus be more fully ventilated.

Let us now turn to the consideration of the effects upon the circulation. The cavity of the thorax may be considered as being

made up of two parts—one, the alveoli and air-passages communicating freely with the external atmosphere, the other consisting of the heart and intra-thoracic vessels communicating with the general vascular system of the body. The inner surfaces of both these cavities are normally under the same atmospheric pressure, the air space directly, the blood-space indirectly through the blood, which, filling the vessels of the body outside the thorax, is subjected, with the body at large, to the general atmospheric pressure. When the inspiratory effort is made, the cavity of the thorax being enlarged by the action of the diaphragm and other muscles of inspiration, not only does the air enter by reason of the atmospheric pressure, but the blood, urged onward by the same atmospheric pressure, acting upon the outside of the body, is driven into the blood-space of the thorax from the general venous system to a degree varying with the depth of inspiration, and with a force which, in a healthy man in full inspiration, is estimated as equal to that necessary to raise a column of mercury 30 mm. Even in ordinary expiration, owing to the elasticity of the lungs and their consequent tendency to contract away from the thoracic walls, the pressure upon the extra-thoracic portion of the vascular system is greater than upon the intra-thoracic by about the amount necessary to raise a column of mercury 5 mm. This is what is known as the thoracic aspiration of the blood. Now let us examine what effect the use of the cabinet will have upon this, supposing, in the first place, the pressure about the body to be diminished. It is obvious that, if the entire atmospheric pressure were to be removed from the periphery of the body, the intra-pulmonary pressure remaining normal, all the blood in the body would be drawn out of the thorax, or, more properly speaking, would be driven out by the intra-thoracic atmospheric pressure into the extra-thoracic vessels, and the circulation of the blood would cease. Any diminution of the peripheral pressure, the intra-pulmonary pressure remaining the same, would institute a tendency in this direction—that is, a tendency to reduce the blood-flow from the extra-thoracic portion of the vascular system into the thorax, and to increase the blood-flow from the thorax into the extra-thoracic portion of the vascular system, thus reducing the amount of blood in the thorax. To put the same proposition in another form. The walls of the intra-thoracic portion of the vascular system are pressed upon centripetally by the direct pressure of the atmosphere. They are pressed upon centrifugally by the indirect atmospheric pressure transmitted by the blood from the periphery of the body. If the

pressure upon the periphery of the body is reduced, the transmitted pressure, acting centrifugally upon the walls of the intra-thoracic vessels, will be reduced, but, the direct centripetal pressure remaining the same, they will be reduced in caliber, and the tendency will be to drive the blood out of the thorax, as we have already seen. An additional tendency in the same direction is due to the fact that, in the fuller inspirations accomplished by the use of the cabinet in the manner described, the small vessels of the lung will be more than usually stretched in the direction of their length, thus reducing their caliber and affording more than usual obstruction to the flow of blood through them. The tendency, however, to dam back the blood upon the right heart will be to a great degree obviated by the fact that the damming-back process will commence before the blood reaches the right heart—to wit, in the vena cava and its intra-thoracic branches, where, owing to the greater thinness of their walls, the pressure will be more effectual than in the thick-walled pulmonary arteries.

It remains to be considered what the effect will be upon the arterial blood-pressure in the general circulation. The pressure upon the periphery of the body being reduced, as we have seen, less blood will flow into the thorax by the vena cava; consequently less will be delivered to the right heart. The pulmonary vessels being reduced in caliber, both by the comparatively increased centripetal pressure and during inspiration by the longitudinal stretching, still further obstruction will be encountered in the flow of blood to the left heart; and, less blood being delivered to the left ventricle, less can be delivered by it into the aorta. The walls of the veins and capillaries being less rigid than those of the arteries, will feel to a greater extent the effect of the diminished pressure; hence the blood, in passing from the arterial to the venous side of the circulation, will meet with less than the usual amount of resistance. Of the three factors, then, which go to determine the arterial tension, two—namely, the amount of blood delivered by the heart to the arteries, and the amount of resistance offered in the capillaries—will be diminished. The tendency will also be to diminish the third factor, the caliber of the arteries themselves increasing by reason of the reduction of the direct pressure upon them. Unless by some means the vaso-motor system is called into play to offset this tendency, it is evident that the arterial tension will be diminished. The blood, then, passing readily through the arteries and capillaries of the general circulation, will tend to accumulate upon the venous side, from which its flow will be retarded by the increased pressure to which it is subjected as

it enters the thorax. The tendency, therefore, of positive differentiation will be toward the exsanguination of the lungs, and consequent relief of local plethora and congestion when they exist, and the lowering of the arterial pressure of the general circulation. Repeated experiments have shown the arterial tension to be reduced, as judged both by the finger upon the pulse and by the sphygmograph. In the case of one gentleman in fairly good health, but who suffers occasionally from slight functional disturbance of the heart, the pulse became intermittent under the differential pressure of half an inch, owing, as I suppose, to the reduced amount of blood delivered to the left ventricle.

It is sufficiently obvious that negative differentiation will have the opposite effect. The atmospheric pressure upon the periphery of the body urging the blood onward, not being counterbalanced by as great an atmospheric pressure within the thorax, will tend to an increased flow toward the thorax, and the increased pressure to which it is subjected as it passes from the thorax into the remaining parts of the body will tend to retard its passage thence; the lungs will, therefore, be subjected to a local plethora, and the tendency will be to congestions and hæmorrhages. The arterial tension in the general circulation will be raised, because, more blood being delivered to the left ventricle, more will be sent by it through the aorta into the general circulation, where a further tendency, acting to raise the arterial tension, will be encountered in the increased pressure to which the capillaries and veins are subjected.

During ordinary respiration, an aspiratory force is alternately exerted and suspended by the movements of inspiration and expiration respectively. Under the influence of alternate differentiation, during inspiration the peripheral air-pressure is diminished; hence the tendency of the blood toward the thorax is diminished; during expiration, on the other hand, the peripheral air-pressure is increased; therefore the tendency of the blood from the thorax is checked. Thus we see the effect of alternate differentiation will be to partially obliterate the undulations in the blood-pressure which normally exist consequent upon thoracic aspiration.

In considering the phenomena connected with the circulation, we have been obliged to confine ourselves principally to the consideration of mechanical effects, disregarding in a great measure the influence of the nervous system. This is due to the inherent difficulties in dealing with the intricate problems which the latter presents; but, the action of the agents which we are considering being

almost purely mechanical, it is fair to presume that their effects will be primarily mechanical, and, at all events, if our reasoning is correct, it at least shows the tendencies of these processes, and, so far as experiment is applicable to the subject, it shows our theories to be in accordance with the actual results.

Two statements are put forward by Dr. Williams and Mr. Ketchum of which I wish to speak, because I believe that they have done much to confuse the subject. The first is one especially dwelt upon in Mr. Ketchum's paper *—to wit, that, in some way which he fails to make clear, the effect of withdrawing a small amount of atmospheric pressure from the periphery of the body is radically different from that of adding an equal amount of pressure to the air communicating with the interior of the lungs, the former acting to expand the chest by a *vis a fronte*, the latter by a *vis a tergo*. A very brief examination of the subject will, I think, suffice to convince us of the error of this view. Under ordinary conditions of air-pressure, the thorax being at rest, the pressure about the body and within the lungs is exactly equal—namely, that of the general atmosphere. When an inspiratory effort is made, the thorax is enlarged; consequently a tendency to rarefaction is produced in the lungs, and air simultaneously passes in to equalize the pressure. On the other hand, when the thorax is contracted, a tendency to compression of the contained air is produced, and air passes out to equalize the pressure. If, however, the pressure of the air communicating with that within the thorax is rendered greater than that of the air surrounding the body, a new element is introduced, for the pressure of the air within the chest, not being fully balanced by the pressure on the outside, tends to expand it by pressing its walls outward, and it seems perfectly evident that it can make no difference whatever whether the inequality in pressure is produced by increasing the pressure of the air which enters the lungs, or by reducing that without. In either case the expansive force is the pressure of the air within the lungs. For, suppose the barometer to-day to stand at twenty-nine inches, and the respired air to be compressed to such an extent that it will raise the mercury column thirty inches. To-morrow the barometer may stand at thirty inches, and we will rarefy the air about the body until it will raise the column but twenty-nine inches. In both cases the pressure within the lungs will be the same—namely, the normal atmospheric pressure with

* "The Physics of Pneumatic Differentiation," "Medical Record," January 9, 1886.

the barometer at thirty inches; in both cases the pressure about the body will be the same—namely, one half pound to the square inch less. It is impossible to see where the conditions differ. That the thoracic walls can be sucked or drawn out by a force acting in front seems absurd when we remember that suction is merely the removing of a portion of the atmospheric pressure from one side of a thing and allowing the full pressure to exert itself upon the other; that it is not a *vis a fronte*, but a *vis a tergo*. To maintain that suction is a force acting directly to draw bodies after it, is, as a scientific proposition, on a par with the statement that nature abhors a vacuum. To put the matter beyond a doubt, I have reversed the breathing-tube of the cabinet, placing the subject of the experiment upon the outside, and compressed the air within the cabinet. The effects produced upon the residual air and upon the pulse, as well as the subjective experience of the person operated upon, were found to be identical with those obtained when he was within the cabinet and the pressure reduced to the same degree.

The other statement referred to is that a most important, if not the main, effect of the positive differential process is connected with the use of medicated sprays or vapors introduced into the air-passages with the respired air, the spray or vapor, as Dr. Williams and Mr. Ketchum contend, being carried to the alveoli of the lungs during inspiration, and there deposited by the compression of the air caused by the commencement of the expiratory act. It is maintained by Dr. Williams that in this manner the tubercular disease can be reached and treated locally by the deposition upon the diseased lung-tissue of an antiseptic fluid. I believe this view to be wholly unwarranted. Waiving the question whether a sufficient amount of an antiseptic introduced into the lungs to disinfect them would not prove extremely injurious or even fatal to the patient, let us consider whether its introduction can be effected if desirable. It is well known that under ordinary conditions it is extremely difficult to introduce spray to any great depth into the air-passages, for the reason that it tends to be deposited upon the walls of the pharynx and in the larynx and trachea. If it should reach the bronchi, the cilia, whose express office it is to prevent the ingress of foreign material to the lungs, would most effectually bar its farther progress. Dr. Williams maintains that by means of the positive differential process—that is, the form in which the air surrounding the body is of a less pressure than that entering the lungs—the tidal air and vital capacity are increased and the residual air

diminished, and that therefore the spray will be carried *farther into the air-passages.* But we found the reverse to be the case; the residual air is increased owing to increased difficulty of expiration. Hence the spray would be carried into the air-passages to a less depth than under normal circumstances. The arguments offered to prove that the spray or vapor is condensed upon the walls of the air-passages to any greater extent than usual seem to me to be based upon manifest errors. In the first place, it is necessary to distinguish between sprays and vapors, which Dr. Williams and Mr. Ketchum do not. A spray is a liquid in a state of such minute subdivision that it will float for a short time in the air. A vapor is the gaseous form of a substance which, at the ordinary temperatures and pressures, is either liquid or solid. One is governed by the laws of liquids, the other by the laws of gases. As the gentlemen have described the process used by them, they employ a simple spray formed by a rapid current of air passing over the mouth of a tube filled with liquid. So far as this is concerned, then, the laws of vapors have no application to the subject. It is conceivable, however, and no doubt in a measure true, that, if a solution of a volatile substance is passed in the form of spray into an atmosphere warmed to the degree of the upper air-passages, a portion of that substance will be vaporized, and we shall have a true vapor to deal with. Furthermore they can, of course, if they see fit, vaporize the substance in the first place before introducing it, so that we shall be obliged to consider the action both of sprays and of vapors. The word condensation as applied to sprays is simply a misuse of terms. Condensation means passing from the gaseous state to the liquid, and a spray can not condense, simply because it is already liquid. It can, however, be deposited upon surfaces with which it comes in contact, simply by reason of its mechanical adhesion for them. This mechanical adhesion is not altered by differences in the atmospheric pressure, and, as has already been shown, under the influence of the process under consideration, the spray carrying inspired air penetrates the air-passages to a less depth than under normal conditions, and the deposition of the spray upon their walls will be lessened rather than increased. With a vapor the case is different. The inspired air being charged with a vapor, the vapor will to some extent pass below the level of the inspired air by the law of the diffusion of gases. This will be true under any circumstances, and it is not alleged, neither is it possible, that the differential process can make any difference with this diffusion; the only effect it will

have will be that, the inspired air not passing so far into the air-passages, less vapor will be carried in. Now, then, is it true that, under a comparatively increased pressure of the respired air, the vapor will be condensed to a greater extent than under other circumstances? To determine this point we must take into consideration the laws governing the condensation of vapors. They are simply stated in Ganot's "Physics": "Condensation of vapors may be due to three causes—cooling, compression, or chemical affinity. For the first two causes the vapors must be saturated." That is to say, they must be in a confined space, and the space must contain so much of the vapor that it can hold no more without becoming liquid.

Now, it is clearly impossible that the space of the air-passages could be brought under the conditions necessary to produce condensation of a medicinal substance by either cold or compression; first, because it is not a confined space, and, secondly, because no such amount of the vapor of an irritating substance as would be necessary to produce saturation could be introduced without suffocating the patient. It is true that this space is saturated or very nearly saturated with the vapor of water, and it is upon this fact that Mr. Ketchum seems to base his argument; but, even if condensation of a portion of this vapor were to be accomplished, it would have no effect upon the vapor of the medicinal substance, for the laws of condensation act upon each vapor independently of the presence or absence of other vapors, and, in order that the vapor of the medicament should be condensed by either cold or compression, the space must be saturated with that particular vapor.

Even if it were possible that the air-space could be so saturated, it is impossible that compression could be applied by means of Mr. Ketchum's device, and of course cold is out of the question. All the compression which is applied to the air at the commencement of expiration is the slight amount necessary to overcome the resistance offered by the friction of the bronchial tubes and the narrow opening of the glottis, and, as neither of these can be affected by the differential pressure, that process can not change the result. Mr. Ketchum, in his paper on "The Physics of Pneumatic Differentiation," * states that "manometric tests show that in respiration, under the circumstances stated, the expiratory effort is equal to a difference of 4·5 inches of the manometer." It would have been interesting if he had stated how he applied the manometer, as, in order to register the compression produced by the resistance of bronchial friction, it must

* "Med. Rec.," January 9, 1886.

have been in direct communication with the air below the bronchial tubes. Of course the result is an error, for the extreme force of a violent expiratory effort in a strong man is only sufficient to raise the manometric column four inches.* If, however, the compression of the air in the lungs were of any value, it could be produced easily enough without any apparatus at all simply by making a strong expiratory effort with the mouth and nose closed.

The first two causes of condensation, then, being excluded, it is evident that such condensation as does take place must be referred to the third cause—that of any chemical affinity the vapor may have for the mucous membrane or the fluid bathing it, including under that term that loose form of affinity which results in a solution. That some condensation does result from this cause is conceded, but that it is affected one way or the other by the differential pressure is neither claimed nor is it possible.

Dr. Williams, however, professes to have demonstrated by experiment that his medicinal substances are in some manner deposited in the alveoli. The experiments reported are: First, cinchonism has been produced by inhaling quinine. Second, symptoms of mercury poisoning have resulted from inhaling the spray of a solution of mercuric bichloride. Third, in a patient with an intercostal fistula, iodine and mercury were detected in the discharge therefrom, after the use of sprays containing them. Fourth, tracheotomy was performed upon a rabbit, and a cannula introduced which was connected with the breathing tube of the cabinet; air-pressure to the extent of nine tenths of an inch was removed from about the animal's body, and a mixture of China ink and water was sprayed into the tube for ten minutes. The autopsy showed pigmentation in the alveoli. In regard to the first and second experiments, some persons are very susceptible to the action both of quinine and of mercury; enough of the drugs to produce the symptoms may have been absorbed from the mouth, pharynx, and upper air-passages, besides which there is nothing to show that a portion of the respective drugs was not accidentally swallowed. In regard to the third experiment, it is very probable that the suppurating cavity communicated directly with a bronchus. Of the fourth experiment, it seems enough to say that the introduction of a spray into a tracheotomy tube in the throat of a rabbit is a very different matter from its introduction into the mouth of a man, to say nothing of the fact that the pressure used with the rabbit was so great that it was necessary to resort to artificial respira-

* Foster's "Physiol."

tion to enable it to expire against the pressure, a condition totally different from any we would be apt to use with a human being.

To sum up, then, we have found that, by means of the differential process in its three forms, we can increase or diminish the difficulty of expiration or of inspiration ; we can increase or diminish the tidal air, the vital capacity, the stationary air, and the residual air. We can to some extent control the amount of blood in the lungs, and consequently control pulmonary congestion and hæmorrhage, and we can raise or lower the arterial blood-pressure. It is hardly possible that such wide-spread phenomena can be induced without producing other and secondary results through the influence of the nervous system and otherwise.

The result of my experience and study has been to convince me that a large share of the benefit derived from the use of the cabinet is due to the reduction of congestion, and consequently of inflammation, in the diseased lung by the differential pressure, in very much the same way as a bandage will afford relief to an inflamed joint. In addition to this, undoubtedly the increased expansion to which the lungs are subjected, and the passive exercise which they are afforded, will do much to modify their nutrition and increase their vitality. The subject is worthy of more thorough and systematic study than it has yet received, which study will, I am sure, convince the profession, if this effort shall have failed to do so, that the theories of Dr. Williams and Mr. Ketchum are erroneous, and that the value of the pneumatic process must rest upon other grounds ; in saying which I do not wish to be understood to disparage the apparatus which those gentlemen have placed before the profession—which I believe, if understandingly used, to be of great value—but only to urge the importance of placing the matter upon its true foundation.

In conclusion, I wish to express my acknowledgments to my friends Dr. B. F. Westbrook and John A. Barrett, Esq., of Brooklyn, for valuable aid in the preparation of this paper.

Paper.

A CONTRIBUTION TO THE CLIMATOLOGICAL STUDY OF CONSUMPTION IN PENNSYLVANIA.

By WILLIAM PEPPER, M. D., LL. D.

I HAVE selected this subject on account of the universal prevalence and terrible mortality of this disease, and from the feeling that any contribution, however slight, to the study of the local conditions which affect this prevalence and this mortality should have some value attached to it. I need not remind you of the important investigation conducted some years ago by Dr. Henry I. Bowditch upon this same subject as applied to Massachusetts. Suffice it to say that, as the result of a careful study of the answers made by resident physicians of 183 out of 325 townships then existing in Massachusetts, this distinguished physician arrived at the following conclusion:

"Medical opinion in Massachusetts, as deduced from the written statements of resident physicians in 183 towns, tends strongly to prove, though, perhaps, not affording perfect proof of, the existence of a law in the development of consumption in Massachusetts; which law has for its central idea that the dampness of the soil of any township or locality is intimately connected with, and probably as cause of, the prevalence of consumption in that township or locality." It is, of course, evident that such a conclusion, if fully confirmed and established as a law, would be of vast and far-reaching importance. It does not interfere in any way with the operation of heredity, or of other predisposing or determining causes. It might have interesting relations, but could not present any incompatibility with the more recent doctrines of the bacillar nature of true tuberculous consumption. It is manifestly difficult to subject this theory to searching and conclusive investigation; but, so far as investigation has been made in other portions of this country or abroad, the evidence has tended to confirm Dr. Bowditch's position.

Independently of Dr. Bowditch, and without knowledge of the views which he had already expressed, Dr. G. Buchanan, of England, had arrived at almost identical conclusions.

MEAN ANNUAL TEMPERATURE IN PENNSYLVANIA.

MAP OF PENNSYLVANIA TO ACCOMPANY A MAP OF THE DISTRIBUTION OF PULMONARY PHTHISIS.

79°

78°

77°

76°

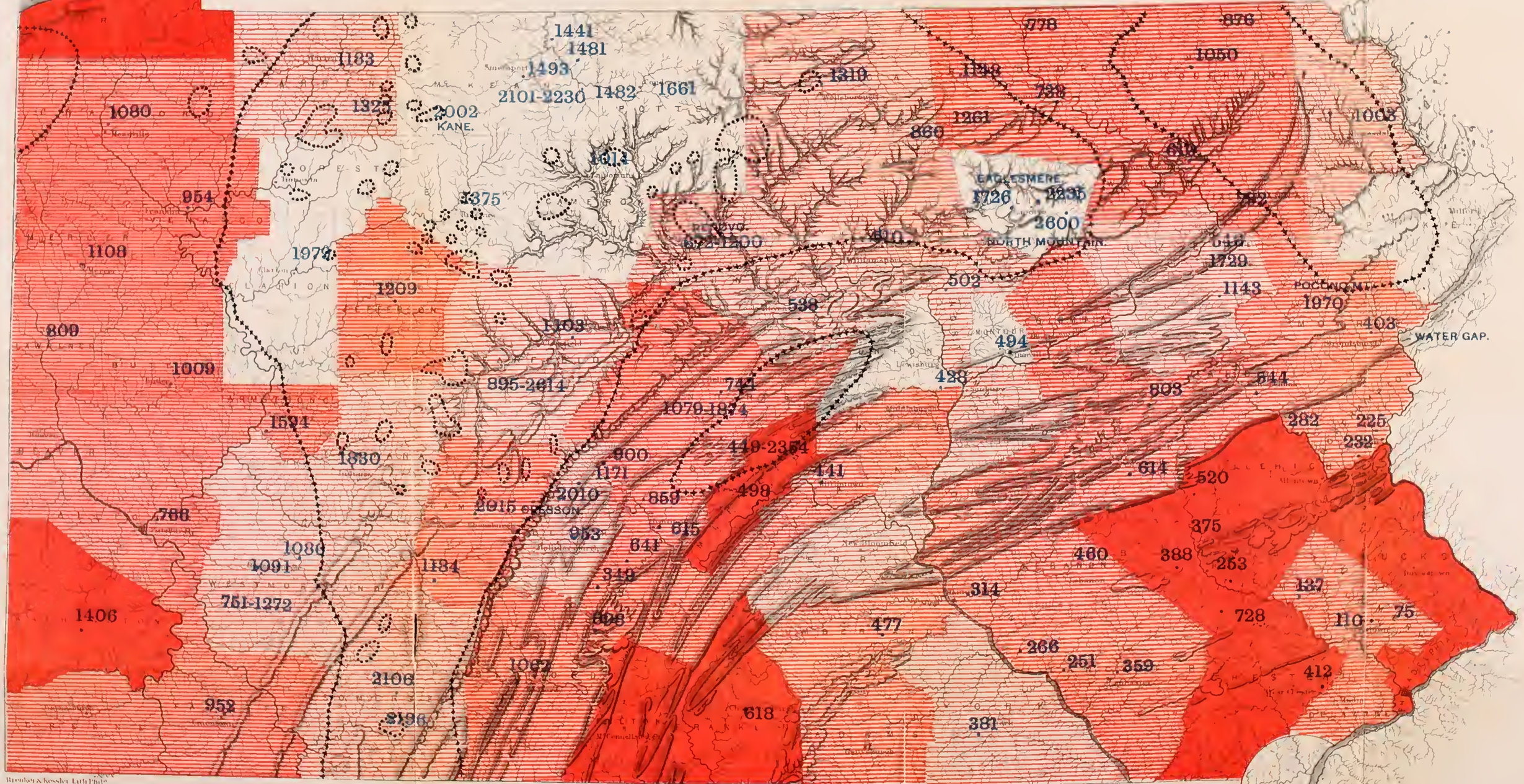
45°-50°

40°-45°

50°-55°

MAP OF PENNSYLVANIA SHOWING THE DISTRIBUTION OF PULMONARY PHTHISIS.

PREPARED BY DR. GUY HINSDALE AND BASED ON THE CENSUS OF 1880.



The base of this map is taken from a topographical map of Pennsylvania by Prof. J. P. LESLEY.

Nº 1.

- Less than 500 persons living to 1 death from Phthisis.
- Between 500 and 750 persons living to 1 death from Phthisis.
- Between 750 and 1000 persons living to 1 death from Phthisis.
- Over 1000 persons living to 1 death from Phthisis.

++++ Areas of standing Hemlock.

····· Areas of standing Pine.

Figures in blue give elevation above tide.

The ninth and tenth reports of Mr. John Simon, Medical Officer of the Privy Council, contain the results of Dr. Buchanan's work, which was carried on in 1865, '66, and '67. Through this investigation it was discovered that in certain English towns where the drying of the subsoil had been accomplished by the construction of sewers, etc., and where the water-supply had been improved, the mortality from phthisis had decreased. In Salisbury the death-rate from phthisis had fallen 49 per cent.; in Ely, 47 per cent.; in Rugby, 43 per cent.; in Banbury, 41 per cent. In towns where no improvements had been made, or where the conditions were already good, there was no such corresponding change in the death-rate.

Dr. Buchanan summarizes the facts brought out in his investigation of phthisis in Surrey, Kent, and Sussex, as follows:

"There is less phthisis among populations living on pervious soils than among populations living on impervious soils."

"There is less phthisis among populations living on high-lying pervious soils than among populations living on low-lying pervious soils."

"There is less phthisis among populations living on sloping impervious soils than among populations living on flat impervious soils."

This connection between the influence of soil and phthisis was established by—

"1. The general agreement in phthisis mortality between districts that have common geological and topographical features of a nature to affect the water-holding quality of the soil.

"2. By the existence of general disagreement between districts that are differently circumstanced in regard to such features; and

"3. By the discovery of pretty regular concomitancy in the fluctuation of the two conditions from much phthisis with much wetness of soil to little phthisis with little wetness of soil."

I will proceed at once, then, to state that in the preparation of this paper I have pursued the method adopted by Dr. Bowditch in his studies of consumption in Massachusetts, which extended from 1854 to 1862, when he delivered his address before the Massachusetts Medical Society on Locality as one of the chief causes of consumption in New England. I think you will agree with me that the result possesses some interest, though I am forced to confess that one of the most striking features brought out has been the paucity of existing records upon a subject of such supreme importance to the community, and the great difficulty of obtaining accurate data even with the most cheerful and courteous co-operation of

the profession. The present address is to be regarded only as the first crude and imperfect result of an investigation, which I hope to be able to continue to a much greater degree of completeness. It may not be without interest to give a short account of the physical characters of the area under consideration, in the preparation of which liberal use has been made of a highly interesting report on the topography of Pennsylvania, which was courteously written at my solicitation by Charles A. Ashburner, Esq., M. S., geologist in charge of the Geological Survey of Pennsylvania.

The State of Pennsylvania measures from east to west 290 miles; from north to south, 150 miles; having an area of over 45,000 square miles. It is a distinctly mountainous State. The Alleghany and Blue Ridge Mountains course diagonally through the central portion from the northeast corner to the southwest; upon the one side the drainage is toward the Atlantic seaboard, and upon the other toward the valley of the Mississippi.

Professor Lesley has suggested a topographical division of eastern Pennsylvania into the Southeastern or the Seaboard district, and the Middle or Appalachian district.

The former is bounded on the west and northwest by the Kittatinny or North Mountain. The latter is bounded on the southeast by the Kittatinny Mountain and on the north by the escarpment of the Alleghany Mountains. The valley of the southeastern district is underlain by the lower silurian limestone, forming rich, fertile soils, and, in the northwestern part of the district, by soils disintegrated from the Hudson River States and shales.

The Appalachian district of the eastern part of the State has been subdivided by Professor Lesley into the (1) Catskill or Pocono wilderness at its eastern end, (2) Anthracite Coal Region, (3) the open country of the middle Susquehanna, and (4) the mountains of the Juniata country, in the heart of which lies the Broad Top coal-basin.

The Pocono division is the continuation of the Catskill Mountains in New York southward into northeastern Pennsylvania embraced within the counties of Wayne, Pike, Monroe, and Lackawanna, and may be said to practically end in the Nesquehoning Mountain west of the Lehigh River. The northwestern part of this division, lying to the east and south of the eastern end of the Wyoming-Lackawanna Valley, consists primarily of an elevated plateau cut through by numerous streams running in many instances in narrow and deep valleys. The elevation of the summits ranges

from 1,200 to 1,800 feet above tide-level. The soils of the district are poor and cold; the region is sparsely settled, but is one of the most healthy sections of northeastern Pennsylvania.

Passing upward from the counties of the southeastern portion, we meet successive chains of mountains; first the Blue Ridge, stretching from Allentown, in Northampton County, to Chambersburg, Franklin County, varying in elevation from 2,000 to 1,000 feet; next the Blue Mountains, from Delaware Water Gap to Gettysburg, reaching an altitude of 2,000 feet. Between the Blue Mountains and the Alleghanies, still farther to the north and west, lies the valley of the Susquehanna River, the branches of which drain parallel chains of long and narrow mountain ridges of unusual uniformity. This Appalachian valley is an undulating plain having a width of from 10 to 18 miles, and is one of the most attractive portions of the State. Its elevation is from 200 to 600 feet.

A glance at the map will show where the Susquehanna has cut its way through successive chains of mountains. These notches at numerous points afford a passage to the Delaware, the Lehigh, the Schuylkill, and the Susquehanna, and in this way an area equal to two thirds of the State is drained across the whole breadth of these mountain chains.

Among these ridges and valleys are broad areas of table-land preserving the same general elevation of the ridges, in the neighborhood of 2,000 feet. Upon this table-land are found, on the north, Kane, Clermont, Williamsville, in McKean County. To the southward, in Indiana and Cambria Counties, we have Indiana, Ebensburg, Cresson; still farther south we have Somerset, Berlin, and Fairhope; in Sullivan County we have Laporte and Eaglesmere. Nearly all these points have an elevation of over 2,000 feet.

This area of table-land, comprising in the aggregate one fourth of the State, rises abruptly as one approaches from the east, and forms a marked barrier 175 miles in length.

Not only is the middle portion of the State more diversified, rivers and their valleys being interspersed through the mountain ridges, but there is a marked difference between its geological character and that of the remainder of the State; it is much older. According to the estimates of geologists, the mountain ranges were at one time ten times as high as they are at present. At no point in Pennsylvania do we now find elevations greater than 2,500–2,700 feet. The upper strata have been swept away from the whole Sus-

quehanna Valley region, leaving the old red sandstone and the older rocks of the Silurian age. When an attempt is made, mentally, to restore the coal-beds stretching from the anthracite region at Wilkesbarre and Scranton to the Pittsburgh coal-fields, together with the accompanying strata, not now seen in central Pennsylvania, we get some idea of the enormous extent of erosion in the middle of the State. According to the estimate of Professor Lesley, five miles of overlying strata had to be removed before the present formations were exposed.

Pennsylvania is noteworthy for its thorough drainage. There is scarcely a lake in its entire extent, and few swamps. The wet lands are of very small extent, and are found in Crawford and Mercer Counties. They do not have an important bearing upon the health of communities. Many of these swamps are covered by laurel thickets, and most of them are less than a mile across their widest portion.

An illustration of the important relation which topography has to the health of inhabitants may be given as follows: McKean County is made up of high elevated plateaus, extensively serrated by rapidly descending narrow valleys having various directions. The valleys descending toward the north and northeast are exposed to the unfavorable storm winds which generally blow from that direction, particularly south of the great lakes. The valleys descending toward the south and southwest are shut off from these winds, and get the full benefit of the warmer winds, coming from the south and southwest, and which are more favorable to healthfulness.

The number of counties is 67, the number of physicians is about 5,000, as nearly as can be estimated. This brief statement indicates the large scope of the inquiry I have started upon. The purpose in view and the points to which it is proposed to direct special attention are shown in the following circular, which has been sent to fully 650 physicians throughout the State:

1811 Spruce Street, Philadelphia.

Dear Doctor: At the meeting of the American Climatological Society to be held in Philadelphia in May, 1886, I propose to deliver the Presidential Address on "The Causes and Distribution of Consumption in Pennsylvania." I can obtain from the last census the population of each county and the mortality from consumption. I am having prepared elaborate maps showing the peculiarities of soil and climate of each county. But I need further facts, which can only be obtained from experienced physicians in each township. I have drawn up the following

questions, which appear to cover the points of chief importance. They are arranged so that in many cases an answer may be given by underscoring a word or by a monosyllable; but, though aware of the labor involved, I beg you to co-operate in this investigation by affording the fullest information possible. Detailed statements of instances of special mortality in families or localities will be highly valuable. A sketch, even though rough, of the local conditions in the latter cases would be of great service.

The great clinical, sanitary, and industrial importance of this investigation will, I trust, justify this appeal for your prompt and cordial co-operation. It may be added that full acknowledgment will be made of all such kind assistance.

Yours respectfully,

WILLIAM PEPPER.

1. Name of town, and population (stating year)?
2. Height above sea level?
3. Location of town—(exposed, sheltered, warm, cold)?
4. What winds—north, south, east, or west—most prevalent?
5. What is the atmosphere generally—(cool, warm, dry, damp; do fogs occur)?
6. Annual amount of rain—(number of inches, great, small, medium)?
7. Annual amount of snow—(great, small, medium)?
8. Is there much shade from woods about the town; through the streets? Has it been necessary to cut down trees for health?
9. Soil—(geological structure, sewers, ponds, bays, meadows, marshes, hills, valleys)?
10. Cultivation of soil—(very rich, good, medium, poor)?
11. What winds are most troublesome to consumptive patients?
12. Is the town specially liable to sudden changes from heat to cold; and is there any marked difference between the temperature at noon and at night?
13. Employment of the citizens in general—farming, factories, mining, lumbering, etc.?
14. Nationality of the citizens—(American descent for several generations, Germans, Irish, Jews, Negroes, other nationalities)?
15. Is consumption prevalent or rare?
16. Is any part of the town peculiarly liable to the prevalence of consumption?
17. If so, what are the peculiarities of the spot or district?
18. Are there any individual houses where consumption has been specially frequent? If so, is there hereditary influence? And what are the conditions of the house as to dryness, dampness, amount of shade, etc.?
19. Is consumption specially prevalent or specially rare among any class or any race—specially Americans, Jews, Negroes—or any occupation?

20. Does consumption run an acute or chronic course in your cases?

21. Do you know of any cases of incipient consumption apparently cured by coming to or by going from your town or district (and, if so, what were the differences of the spots)?

22. Is consumption, as you see it, caused or promoted by hereditary influences (and in what percentage of cases)?

23. Can consumption be apparently prevented from occurring in children so hereditarily disposed, and by what means?

24. Have you any evidence in support of or against the contagious or infectious character of consumption?

25. Is malaria prevalent in your town? If so, is consumption specially prevalent in the malarial districts?

26. Is rheumatism prevalent in your town?

27. Is pneumonia prevalent in your town?

28. Is Bright's disease prevalent in your town?

The following resolutions were adopted by the State Board of Health and Vital Statistics of the Commonwealth of Pennsylvania, at a regular meeting held at Harrisburg, November 11, 1885:

Resolved, That this Board has learned with deep interest of the methodical and searching investigation into the territorial distribution of consumption in this State, now being prosecuted by Professor William Pepper; believing that it will not only add to our general knowledge of the causes of this most wide-spread and fatal of all diseases, but that it may also result in the discovery of regions of comparative exemption from its ravages within our own borders.

Resolved, That this Board bespeaks the cordial co-operation of physicians throughout the State in making this effort fruitful of results.

Resolved, That Professor Pepper be requested to put his deductions into such shape that the Board may be able to utilize them for the public good in its annual report.

It will be seen that the above questions aim at securing information about the general climatic topographical and geological relations of consumption, and especially about the influence of different local conditions rendering or tending to render the disease peculiarly rare or peculiarly prevalent; about the relations of occupation, race, and heredity to the occurrence and course of consumption and some other diseases as regards the above local and general causes. Considering the amount of time and labor required to answer carefully, even in the briefest manner, so many questions as the above circular contains, I feel that the fact of having received 120 replies representing 47 counties, many of them of elaborate character, is ample proof of the interest felt by the profession in this investigation, and calls for the warm expression of my thanks, which I now beg to make to

all of my correspondents. In addition to the material thus placed at my disposal, I have made liberal use of the mortality and vital statistics as prepared by Dr. John S. Billings for the census of 1880. Nor can I neglect this opportunity of referring to the great practical value of this colossal work. Despite the serious defects of the statistics resulting from the absence of any national system of registration of vital statistics such as is relied upon by all other civilized nations for the purpose of ascertaining the actual movement of population, the improved method employed in this tenth census and the ability shown by Dr. Billings in the arrangement and analysis of the results render the two volumes which have just appeared highly valuable to the profession and highly creditable to the genius and energy of their distinguished author. So far as concerns Pennsylvania, Dr. Billings's statistics are based upon 2,342 returns out of 4,661 registers of death sent to different physicians in this State.

I have also used all available published mortality returns in Pennsylvania, but it is a striking fact that there are none such provided save in Philadelphia and Pittsburgh.

With these data, and using Professor Lesley's topographical map as a basis, Dr. Guy Hinsdale, to whose intelligent and energetic co-operation this report largely owes its existence, has prepared for us maps showing the prevalence of consumption in Pennsylvania counties, and the relations between such prevalence and elevation, and mean annual temperature and rain-fall. It gives me pleasure also to acknowledge the kind co-operation of Dr. Hare in the collection and collation of material for this study.

As is doubtless known to you, the unit of locality used in the tenth census is the county; but, as it was impossible to give full statistics of the 2,605 counties in the United States, it was decided to give for the county only the total mortality at certain groups of ages and the number of deaths from a few diseases of special interest, and to do this only for counties having a population of 10,000 or upward. The more elaborate compilations were made for groups of counties within the limits of each State, which are called State groups. These groups were selected by Mr. Henry Gannett, the geographer of the census.

The State groups of counties can evidently be consolidated by States, or they can be combined into what the census calls grand groups, whose boundaries are determined by topographical peculiarities and not by State lines. Of these grand groups there are no less than twenty-one recognized in the tenth census, in only two of which

—viz., No. 6, the central Appalachian region, and No. 8, the interior plateau—does Pennsylvania appear, the important city of Scranton being in the former group, while in the latter the cities of Philadelphia, Pittsburgh, Allegheny City, and Reading are included. The counties of Pennsylvania are divided in the census into two groups, the first of which contains thirty-nine, viz.:

Adams, Bedford, Blair, Bradford, Cambria, Carbon, Centre, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Fayette, Franklin, Fulton, Huntingdon, Indiana, Juniata, Lackawanna, Lebanon, Luzerne, Lycoming, Mifflin, Monroe, Montour, Northumberland, Perry, Pike, Schuylkill, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Wayne, Westmoreland, and Wyoming.

And the second twenty-eight, viz.:

Allegheny, Armstrong, Beaver, Berks, Bucks, Butler, Chester, Clarion, Crawford, Delaware, Elk, Erie, Forest, Greene, Jefferson, Lancaster, Lawrence, Lehigh, McMean, Mercer, Montgomery, Northampton, Philadelphia, Potter, Venango, Warren, Washington, and York.

In the preparation of Map No. 1 it has been found desirable for the purposes of demonstration to divide these counties differently, and to make four groups, as follows:

Group I (Less than 500 Persons Living to One Death from Phthisis).—Berks, Bucks, Chester, Erie, Franklin, Fulton, Lehigh, Mifflin, Philadelphia, and Washington.

Group II (Between 500 and 750).—Adams, Allegheny, Armstrong, Beaver, Bedford, Bradford, Butler, Cambria, Carbon, Centre, Columbia, Crawford, Cumberland, Dauphin, Delaware, Fayette, Greene, Huntingdon, Jefferson, Juniata, Lackawanna, Lancaster, Lawrence, Lebanon, Mercer, Monroe, Montgomery, Northampton, Schuylkill, Snyder, Susquehanna, Venango, and Wyoming.

Group III (750 to 1,000).—Blair, Clearfield, Clinton, Indiana, Luzerne, Lycoming, Northumberland, Perry, Somerset, Tioga, Warren, Wayne, Westmoreland, and York.

Group IV (Over 1,000).—Cameron, Clarion, Elk, Forest, McKean, Montour, Pike, Potter, Sullivan, and Union.

Group No. 1 embraces those areas where there are less than 500 persons living for one annual death from consumption.

Group No. 2 embraces those areas where there are between 500 and 750 persons living for one annual death from phthisis.

Group No. 3 embraces those areas where there are 750 to 1,000 persons living for one annual death from phthisis.

Group No. 4 embraces those areas where there are over 1,000 persons living for one annual death from phthisis.

The same information which is displayed in this map by means of different degrees of shading is shown in tabulated form (see Table No. 2), with the addition of information as to the total population, the total death-rate per thousand, the number of persons to one square mile, and the number of square miles, the general character of the occupation of the population, and the mortality from malarial fever and pneumonia.

In considering the mortality from consumption, as shown by this table, it will be seen that there is not any striking disparity between that of the census group No. 1, which gives a rate per thousand of 14·9, and that of No. 2, which gives a rate of 13·2. This is noteworthy, since in the latter group the total population was 2,344,089, of which only 96,881 were living in the cities of Scranton, Pa. (45,850), and Paterson, N. J. (51,031), while in the interior plateau group, with a population of 5,714,683, and containing no less than 1,388,416 residents in cities (Philadelphia, 847,170; Pittsburgh, 156,389; Allegheny, 78,682; Reading, 43,278; and in cities out of Pennsylvania, 262,897), the rate of death from consumption per 1,000 population was only 14·9.

Equally remarkable is the composition of our first group of counties where there are less than 500 persons living to one annual death from phthisis, since it contains Philadelphia, with 129 square miles, and 6,567 inhabitants to the square mile.

Group 1.			Group 4.		
	Sq. mile	Persons per sq. m.		Sq. mile	Persons per sq. m.
Philadelphia	129	6,567	Clarion	570	71
Lehigh	360	183	McKean	1,000	42
Berks	900	125	Union	310	35
Bucks	590	116	Montour	600	33
Chester	760	110	Sullivan	430	19
Erie	770	71	Elk	770	18
Franklin	760	66	Pike	600	16
Washington	890	61	Cameron	400	14
Mifflin	380	52	Potter	1,070	13
Fulton	440	23	Forest	376	12

It is true that in Group 4, which comprises the counties with the lowest mortality from phthisis, and which we have placed by the side of Group No. 1 for comparison, the population is in every county very sparse; yet it seems evident that mere density of population has not a powerful influence in this question. The high gen-

eral death-rate in Philadelphia, 20·4 per thousand, is certainly attributable in large part to other causes. However, it will be observed that all of the counties with high mortality from consumption have very little elevation, and, further, are seated in the areas of largest annual rain-fall. This remark is not applicable to Washington County, the returns from which are so much at variance with the others as to suggest inaccuracy.*

It may be noted that in Erie County, which has considerable average elevation, the mortality may be influenced by the proximity of the lake, and by the presence of a considerable body of low, wet land.

Having alluded to the possible influence of rain-fall, it is proper to call attention to Map No. 2, which shows the general distribution of mean elevation and of mean annual rain fall in Pennsylvania. The figures in black indicate the general elevation of the irregular areas in which they are placed, and which are further distinguished by the varied shading. Of course, in a State of such large dimensions and of such diversified surface as this, there are points in every county which depart widely from the general average here given; but, notwithstanding, it will be found that the data of this map accord quite closely with the most important facts, and give a good general impression of the characters of the different districts.

It will be observed at once that those portions of the State where phthisis is rarest are the most elevated, having a general altitude of 1,500 to 2,000, or, better still, of 2,000 to 3,000 feet; while, in proportion as we enter districts of lower general altitude, we find correspondingly increasing rates of mortality from consumption. In explanation of the lines indicating mean annual rain-fall, it must be said that the small area above the isohyetal line of 35″ yields an annual precipitation of from 30″ to 35″; the area between the line of 35″ and that of 40″, comprising about two thirds of the entire State, gives a mean annual rain-fall of from 35 to 40 inches, and the area below the line of 40 inches an average annual rain-fall of from 40″ to 45″. In the area of maximum rain-fall will also be found Erie County, where the average for a series of years has been 42 inches. Some general correspondence will also be noted between these areas of rain-fall and the areas of varying mortality

* As further evidence of probable inaccuracy in the returns from this county, it may be stated that the statistics from the Surgeon-General's office show ninety-two deaths from consumption among females, and only forty among males.

from consumption, the higher figures among the latter coinciding with areas of greater precipitation.

It will be seen farther on, in the more minute study we have been able to make of Philadelphia, that the influence of elevation and of density of population appears to be considerable, and in accordance with what we have above stated. Before leaving the consideration of the general physical features of the State, attention may be called to the areas on Map No. 1, inclosed respectively by lines of black dots or of small crosses, the former of which indicate areas of standing pine, and the latter areas of standing hemlock. Unfortunately, the destruction of our timber has been so unscientific and wanton that the statement of the actually existing forestiation in this as in many other States has little value from a climatic and medical standpoint, and is of only commercial interest. It is probably near the truth to say that the areas of standing hemlock represent what would have been areas of pine but for the wholesale destruction of the latter. It will be seen that these great areas correspond quite closely, for the most part, with those of the most favorable climatic conditions, and the greatest immunity from consumption.

Opportunity has been taken to place on Map No. 1 a few of the well-known health resorts of Pennsylvania, such as Pocono, North Mountain, Eaglesmere, Renovo, Kane, and Cresson. The elevation of these and similar points which might be named is considerable —from Renovo, where the hotel actually stands about 1,200 feet above sea-level, to North Mountain, 2,600 feet. The natural beauties and advantages of these points are unsurpassed, and nothing is required but a clearer appreciation of their excellence as sanitary stations and better facilities of access and accommodations for visitors to render them as attractive and valuable as any health resorts on this continent.

As would be expected, the study of the isotherms yields results closely corresponding with those already stated as to elevation and rain-fall; and, as the influence of the mean annual temperature may be regarded as only incidental where it presents such limited variations as exist here, it is sufficient to call attention to Map No. 3, in which the isotherms and the respective areas they include are shown so as to be easily studied in connection with the facts given in the other maps.

Turning now from this general survey of the mortality statistics and climatic conditions of Pennsylvania, the more important question

arises whether the data at our disposal indicate marked differences in the distribution or prevalence of consumption in areas much smaller than the counties, and whether, if so, any connection can be traced between such varying degrees of prevalence and any definite local causes or conditions. I had originally thought of preparing a map showing the geological features of the State to be studied with the other maps already described. But, as Professor Lesley pointed out to me, all the main geological formations lie at such a depth below the surface that it can not be supposed they produce any material effect upon those living above them; and, on the other hand, the surface conditions are so numerous and diverse that it would be impossible to portray them even for a much smaller area than the one we are considering. It will be observed that the list of questions sent to physicians throughout the State included several which were framed with the special object of securing information as to local conditions which might thus affect the frequency and cause of consumption. Dr. Bowditch attributed the result of his investigation entirely to the presence in his circular of two questions suggested by Dr. John Ware, namely: "Is any portion of your town peculiarly liable to the prevalence of consumption?" and "If so, what, if any, are the peculiarities of the spot?" It will be seen that in my circular, which was prepared after consultation with Dr. Bowditch, I included these same two questions (see 16 and 17); and others were inserted in the hope of eliciting information of this special and definite character.

Let us now turn to a detailed study of the 120 answers which have been received, for which purpose they have been carefully tabulated under the heading of each question, and, further, an abstract of the answers from each county has been prepared, which is given in the appendix.

As the point of special interest in the investigation is most directly touched upon by Questions 15 to 19, inclusive, the result of the answers to these will first be considered. In response to the question, "Is consumption prevalent or rare?" there are 112 replies, of which 64 state that the disease is rare or very rare, 37 that it is prevalent, and 11 that it is moderately prevalent.

From the counties making Group No. 1, excluding Philadelphia, which will be separately discussed, there are 21 replies, of which 14 state that the disease is rare and 7 that it is prevalent. Yet it will be noted that these replies are all from counties which give the highest mortality from phthisis—a fact which shows conclusively

how wholly insufficient are the data at my disposal for enabling me to draw any general conclusions. From the counties making Group No. 4, the general statistics of which show an annual mortality from phthisis of more than a thousand living, I have been able to secure only four replies, one of which states that the disease is prevalent, one that it is moderately prevalent, one that it is rare, and one that it is very rare.

In regard to Question No. 16, "Is any part of the town liable to the prevalence of consumption?" I have received 109 replies, of which 86 are negative and 8 affirmative. The first of these affirmative answers is from Dr. George F. Horton, of Terrytown, Bradford County, who states that, although the disease is rare and 50 per cent. of the cases are due to heredity, it is comparatively frequent in that part of the town which is situated on the river and where malaria also is prevalent.

A second affirmative answer is from Dr. H. A. Arnold, of Merion Square, Montgomery County, who states that, although consumption is seldom met with and 75 per cent. of the cases are hereditary, there is one house in the hollow where three cases of consumption occurred within a short time. The special characters of this house will be considered shortly.

The third affirmative answer refers to South Bethlehem, with a population of 5,000 inhabitants, at an elevation of 400 feet. Consumption is not markedly prevalent, but a certain part of the town on made ground, lying low near a brook, which acts as an open sewer, is thought to be associated with the prevalence of the disease. It can not be said that any individual houses have been specially the seats of this disease.

The fourth affirmative answer is from Dr. H. H. Bordner, of Shamokin Dam, Snyder County, which is a small village of 300 inhabitants at an elevation of 800 feet. Low and swampy areas are associated with phthisis; so also are certain damp houses. Consumption is especially prevalent in malarial districts.

The fifth affirmative answer is from Dr. W. T. Bailey, of Dillsburg, York County, who says that while consumption is rare in this town, with a population of 500 and an elevation of 1,065 feet, there is a central part of the town where it is frequent. All of the houses in that area have damp cellars and yards.

The sixth affirmative reply is from Dr. J. C. Gable, of York, York County, who says that consumption is prevalent in the damp portions of the town, where the houses are all more or less damp.

The seventh affirmative reply is from Dr. T. J. Ward, of Ridgway, Elk County, a town of 2,000 inhabitants, with an elevation of 1,437 feet. Consumption is moderately frequent, but nearly all the cases have occurred in the neighborhood of a tannery on the north side of the town near the Elk Creek.

Dr. R. Leonard, of Mauch Chunk, Carbon County, in a communication received too late to embody in the tables, says: "The mountain is so steep and high on the street as to put the dwellings on that side in the shade. At one point there are about twenty dwellings upon which the sun never shines for three months of the late fall and early winter. It is here that consumption especially prevails. There is a marked difference in the number of cases on the north and on the south sides of the street, the south side giving the greater number. The Second Ward, situated upon a bluff 200 feet above the First, is open and exposed to all winds. Here consumption is not so prevalent, though pneumonia and rheumatism are frequent."

The statistics obtained from Philadelphia may be taken as an eighth affirmative reply. This city has the largest population, many wards having from 120 to 150 inhabitants to the acre. It varies in elevation from 0 to 440 feet. Consumption is prevalent. A glance at Map No. 4 will show at once those wards having the greatest mortality from phthisis. They are the First, Second, Third, Fourth, Fifth, Seventh, Eighth, Ninth, Sixteenth, Seventeenth, Eighteenth, Twenty-seventh, Twenty-ninth, and Thirtieth. A study of this chart will also show that these wards are in general characterized by a low elevation, greater density of population, and, on reference to the chart of water-supply, water of inferior quality.

In a communication from Dr. F. F. Davis, of South Oil City, Venango County, occurs the following interesting paragraph bearing on this question:

"Oil City is built partly on the north side of the river and partly on the south side or left bank. On the north side, part lies low and wet, with insufficient sewerage, and part lies high on a hill—about 150 feet above the river. On the south side one part is on the second bottom of the river, 30 to 35 feet above the river, and has a porous soil underlaid by gravel; part is on the hill, 100 to 200 feet above the river. Consumption is about *as common in one part as another*. I think consumption causes about 20 per cent. of adult deaths. It did the year I kept the record for the Census Bureau."

It will thus be seen that the vast majority of my correspondents deny the existence of any center in their town where consumption is

specially prevalent, but that, in a few instances where such special localized prevalence is asserted to exist, the local conditions are those of dampness, bad drainage, and excessive soil moisture, which are generally believed to favor the development of the disease. It is evident, however, that, unless continued inquiries which I hope to make shall elicit additional information at variance with the general tenor of the replies thus far received, it must be conceded that the evidence available does not point to excessive soil moisture as the main causal condition of consumption in this State.

In regard to Question No. 17—"If there are any parts of the town peculiarly liable to consumption, what are the peculiarities of the spot or district?"—there are but seven who reply that they have noticed any such peculiarities, and these speak of damp yards and bad sewers, and low ground by the river-side.

In reply to Question No. 18:

As to any individual house where consumption has been especially frequent, there are ten replies. The evidence of these replies is not, however, entirely concordant. On the one hand, Dr. W. G. Stewart, of Newville, Cumberland County, writes that, in one house, five young persons from ten to seventeen years of age died of consumption. The parents were robust and healthy, and there were no hereditary influences. The house, however, was shaded by large and numerous trees and was damp, with no drainage; water stood in the cellar, and the house was built on what is called "spouty land," and, further, it was not well ventilated. In another house in the same town, with bad ventilation, wet cellar, and no drainage, there was a large family, with hereditary tendency, who died of consumption. Dr. W. D. Bailey, of Dillsburg, York County, in like manner describes a house with several repeated fatal cases of consumption where the local conditions of the house were very unfavorable.

Dr. H. A. Arnold, of Lower Merion, Montgomery County, describes a house in a hollow, fifty yards east of a brass mill, where in three cases, two of them children from fourteen to sixteen years of age without heredity, and one an adult of consumptive family, all ended fatally. The locality was damp, and especially was the air charged with vapor from the melted brass, so that the case is complicated by the possible action of these irritating particles as a cause. In the other instances it is distinctly stated that hereditary influences co-existed.

Dr. William P. Noble, of Upton, Franklin County, writes:

"There is one house in the town in which the members of an entire family have died from consumption, but in this instance there was an hereditary influence, with, perhaps, a local condition favorable to the development of the malady. The house is of stone, well shaded on the north, east, and south, and is cool and damp even in warm and dry weather. The grounds surrounding it, which are ample, are of a damp, marshy character, and occasionally I have noticed gaseous matters escaping from it which were quite perceptible to the smell. The family spoken of consisted of the parents and four daughters. The father died at the age of sixty, the mother at fifty, and the daughters between twenty and thirty. For a number of years I noticed that all the cats kept about the premises took consumption and died of it. The family now living in the house, with the exception of one daughter, has been free from any symptom of the disease. The daughter, eighteen years of age, had several slight hæmorrhages about one year ago, but I am not positive that they were of tubercular origin. She was in pretty fair health in the spring, at which time she went West. I learn that she has been enjoying good health since then."

Dr. J. E. Rigg, of Stonerville, Westmoreland County, writes:

"Mr. and Mrs. Lane came to this township when young, seemed to be very healthy, lived to be quite old, and died without any evidence of lung trouble. Nothing known of their family history. They lived almost entirely in the basement of a stone house, which was damp and very poorly ventilated. In this part of the house they raised six children; all lived to manhood and womanhood. Since then four of the six died of consumption; the other two know nothing of the four who remained here and died of consumption. Two of them married one man of very good family history and he of good health. The man is now suffering from consumption, having lived with the two women in all about thirty years. The children of the four whose history we have (the grandchildren of the old couple, Mr. and Mrs. Lane, some ten in number), all have consumption; some have died, others advanced, and others yet just beginning. Change of climate has been tried with some, but with little benefit.

"Their habits were good: as a rule, little shade about the house. Spring of water just outside the wall of the basement."

In an interesting series of cases which came under my own observation, I had the question of heredity and of local influences studied carefully by Dr. Judson Daland with the following results:

Mrs. Jane Kief Garrity's mother was eighty-three years old when she died after two weeks' illness. Exact cause unknown. Her father was eighty-three years old when he died of kidney disease. They both were vigorous and strong, as were the rest of their immediate family as far as Mrs. Garrity could remember; they all lived and died in Ireland. She has

five brothers, who are living and healthy to the best of her knowledge. One sister died in 1879. when fifty years of age, rather suddenly, after four days' illness; the exact cause is unknown, but she had asthma and malaria, and was very anæmic when Dr. Reid saw her. The remaining sister is alive and healthy.

Mrs. Jane Kief Garrity is now fifty-two years old, has always been stout and hearty, and is so yet. She married when about eighteen years old, just one year after she left Ireland; never showed tendency to pulmonary disease. Began menstruating when about thirteen years of age. This function ceased about one year ago.

Mr. Robert Garrity married the above when he was thirty years old; never developed tendency to pulmonary disease; was always well and strong; always a hard worker in a mill, where he was exposed constantly to great extremes of heat and cold; was probably a regular drinker of whisky, though never to excess except in two instances. He occasionally suffered from abdominal (internal?) colic from over-indulgence in cold water when heated. He died in 1871, when fifty years of age, from the effects of a severe burn received at the mill.

His father died when over ninety years of age. He had no special disease. Probably simply died of old age. He was always a hard worker. No lung trouble whatever. His mother died rather suddenly when seventy years of age. Cause unknown. If she had had phthisis, Mrs. G. would have known it.

One brother died early of variola. The remaining two brothers are probably alive and well.

His four sisters are all living and healthy.

Mr. and Mrs. Garrity's Offspring.—1st. One boy was born in Pottsville about 1851, and died, after two days' illness of croup (?), when fifteen months old. All children subsequently were born in an old house on the west shore of the Schuylkill River, in Conshohocken, Pa. They moved to new house, their present home, in 1875–'76.

2d. Boy was born in 1857, lived ten months, and died of summer complaint.

3d. Lizzie was born in 1858 and seemed healthy. No serious illness. Menstruation began late, when eighteen years old. She worked in a woolen mill, the air of which is filled at all times with fibers, dust, etc., but Dr. Reid says the other two hundred girls did not develop pulmonary diseases more frequently than those having other occupations. Her fatal illness lasted about six months. (Age at death, twenty to twenty-two.)

4th. Mary was born in 1860. Always rather thin, but never sick. Began menstruating when sixteen or seventeen. Fatal illness began in March, 1882, and terminated (ten months) in January, 1883, in her twenty-second year.

5th. Mary Jane was born about 1863. Was stout and hearty. Menses began when fifteen years old. Began losing flesh before going to the mill,

where she remained one year. She died, when twenty-one years old, October 25, 1884, after six months' illness.

6th. Annie was born in 1864. Always well and strong. Worked two years in a mill. Died in December, 1882, when nearly nineteen years old, after six months' illness.

7th. Julia, born in 1866, worked in a mill until two years before her death, which occurred from phthisis in February, 1882, in her sixteenth year, after an illness of eight months.

8th. Robert, born in 1868. Always well and strong; is tall and seems strong. Chest rather poorly developed, shoulders overhang, stoops; pulmonary resonance good everywhere. Now working in an iron mill about as his father did. Now seventeen years old.

9th. Katie, born in 1870, and therefore fifteen years old, always strong and well. Now looks the picture of health and strength. Stout, well developed; menstruates. Chest full, well shaped, and expands well during inspiration.

All of the girls had small waists—so much so as to suggest tight lacing. All the cases began in the same way, with slight hacking cough, irregular fever (partially influenced by ext. cinchonæ fld., or Warburg's tr.), rapid pulse (90–110–120), pains in the chest, which expectoration would increase; only occasional slight attacks of hæmoptysis; profuse night-sweats; and cessation of the menstrual flow. Gastric digestion poor.

The disease would begin at one apex, infiltrate that lung, and then infect the other. Toward the last, cavities would form.

While sick they were carefully nursed and placed in separate rooms, rendering the notion of contagion improbable.

Careful cross-examination failed to associate the beginning of these cases with any direct exciting cause other than the mill.

Dr. Reid believes all the cases were complicated by malaria.

The average duration of the disease was six months, except in Maggie's case, which lasted nine months.

Topography, Hygiene, Drainage, etc.—The house in which the children were born was situated on the west bank, about one hundred feet from the Schuylkill River. The situation is exceedingly bad, all the drainage being on the surface, and emptying into the river. Once or twice a year there would be a freshet, and this particular spot is so situated that the swift current strikes the shore with great force and deposits six or more inches of thick, bad-smelling mud. After each freshet there would be an outbreak of intermittent fever. In this neighborhood there are cases of malaria, more or less, all the time.

The drinking water was obtained from a well, and was poor in quality. The soil is so porous that it would be easy for matter to drain into it.

Twenty families were also exposed to the above unfavorable influences, but pulmonary diseases were no more frequent than elsewhere. They moved to present house about 1868 or 1870.

The house where these cases developed is situated within a few feet of the top of a steep hill, about 600 or 700 feet from the river and 80 to 90 feet above the level of the river. The ground is *dry*, composed chiefly of shale and small, flat pieces of stone. The cellar is perfectly dry and clean. The drainage is all above ground, and the cess-pool is some distance from the house. The rooms are all clean, large, airy, and well ventilated, though all the ceilings are low—about seven and a half feet high.

The drinking water is obtained from a well, and seems to be of good quality. I could find no source of contamination.

This house and its location seem to me to be particularly healthful (excepting the low ceilings). JUDSON DALAND.

As would be expected, the answers to many of the questions bearing upon points of climate and topography are so varied as to render it impossible to draw any conclusions from them. Thus, in regard to the prevalent winds in those localities where consumption is frequent, it is only when, as in certain locations, the trend of mountain ranges or of rows of high hills, is such as to render towns in the inclosed valleys accessible to the winds which sweep through these valleys from certain quarters, that it can be said that the prevailing direction of the winds has a definite bearing upon the tendency to pulmonary disease.

A glance at Map No. 1 will show that this remark applies to a number of interior counties, as Fulton and Mifflin, which are traversed by parallel mountain ranges, so as to favor this effect of the wind.

Dr. Davis, of Venango County, writes:

"Our winds are very variable, sometimes blowing from different directions two or three times in a day." "The winds most dreaded by our consumptive patients are, when an east wind has been blowing (or one from the south), the wind suddenly changes to the north, producing a sudden fall of temperature."

While, however, the evidence is thus meager and conflicting in regard to the influence of local conditions upon the origin and prevalence of consumption in various parts of the State, the responses to Question 22—"Is consumption, as you see it, caused or permitted by hereditary influences, and in what percentage of cases?"—are strikingly uniform. This question is answered more or less fully in 94 of the communications I have received; in 87 the reply is affirmative; in only seven instances does the writer deny the existence of heredity in his cases of consumption. The percentage of cases in which heredity has been noted is stated in 31 replies. Only once is it

given as low as 25 per cent., 6 times as 50 per cent., 12 times at from 60 to 75 per cent., 7 times at from 80 to 90 per cent., and as existing in every case in three replies. This concurrence of belief in the great power of hereditary influence upon the development of consumption is, of course, in accord with general belief, though I confess it is more uniform and positive than I had expected to receive.

As bearing upon the current discussion of the contagious or infectious character of consumption, the replies to Question 24 are interesting. This question was, "Have you any evidence in support of or against the contagious or infectious character of consumption?" There were 45 affirmative replies.

Dr. William D. Bailey, of Dillsburg, York County, relates an instance in which a house had been built in an excavation in a hillside and which had a small yard on the east and south; this yard is always damp. As the house is in the shape of the letter L, little or no air can sweep through it; neither do the rays of the morning sun reach it until high up.

"In this house I have attended two cases of consumption—sisters. Both terminated fatally; the eldest died after suffering about three years; the younger slept with her, and soon after her death took it and died in about five years after. I observed what I thought alarming symptoms in a third sister, but forbade her sleeping with the affected sister, and now she is in reasonably good health. I can trace no hereditary taint in the family."

Dr. C. B. Wood, of Monongahela City, Washington County, Pa., is a firm believer in the contagious character of consumption, and offers the following evidence:

Case I.—Three children in a negro family died of consumption, all under twelve years of age. The father and mother died of the same disease a few years later.

While the children were sick and dying, a robust young man—negro—whose parents are strong, healthy people, boarded with this consumptive family, during which time he was taken sick, and in his case were present all the symptoms of consumption excepting hæmorrhage and those symptoms found after there is an actual destruction of lung-tissue. He was sick about three months, was greatly emaciated, and I thought must surely die, but he recovered, and is strong and healthy to-day, after five years.

Treatment.—Change of boarding place, cod-liver oil, syr. hypophos. cp., rich milk, and a little good whisky.

Case II.—A young woman aged twenty-six, unmarried, came to her

aunt's to live, or rather to die, as she was in the last stages of consumption.

A cousin of the consumptive slept with her. After several weeks' attendance I was asked to see the girl (whose age was eighteen). She complained of pain in apex of right lung, had a cough, had been having night-sweats, loss of appetite, and physical signs of disease in the lung.

I at once ordered her not even to stay in the same room with the consumptive, placed her under treatment, and she recovered and is living to-day in good health.

Case III.—Mr. A., a farmer, died of consumption. His wife, whose family history was excellent, was taken sick shortly after her husband's death, and died of consumption within two years.

Case IV.—Now under my care. Young woman, married four years ago. Husband had hæmorrhages previous to marriage. Two years after marriage went to Mexico to practice medicine, was taken worse, and died of consumption. The wife was with him probably two and a half years altogether of their married life. Her history on father's side not very good, on mother's side excellent. But, when I remember what a picture of health she was previous to marriage, I can not but believe that her husband at least caused the development of her present disease, consumption, if latent, if he did not sow the seed. She spent the last two winters in Boston, and is now in Monongahela City with her mother. Her present condition is alarming, and she is now undoubtedly in the second stage of consumption.

Dr. J. J. Koser, of Shippensburg, Cumberland County, relates a case in which consumption occurred in a lady thirty-six years of age, apparently contracted by nursing a relative of her husband's, who died of consumption about a year before she consulted Dr. Koser. She was then moderately far advanced in disease. She had no history of consumption in her family, but, on the part of her husband's family, there was a history of consumption, and, about a year and a half after death of the wife, the husband died of the same disease. They had three children who are apparently healthy at the present time.

Dr. Carr, of Schuylkill County, writes:

"I have known several women who were married to consumptive men, and several men who married consumptive women. The children on both sides were apparently healthy till they began to arrive at the age of puberty, when they showed signs of consumption, thus showing an hereditary taint; the parents who were healthy being in good health, while those that were suffering from consumption have died; and many of the offspring died of well-marked consumption, in its acute form, as they arrived at the ages of eighteen or thereabouts."

Question No. 19—"Is consumption specially prevalent or specially rare among any class or race—especially Americans, Jews, negroes—or any occupation?" Twenty-five stated that no class was specially affected, or that all classes were equally affected; 21 stated that the disease attacked chiefly Americans; 14, negroes; 5, Irish; 2, Germans; 3, Swedes; 1, Indians (Carlisle); 4, miners; 3, axe-grinders; 2, cotton-factory operatives; 1, stone-cutters.

PHILADELPHIA.

More careful attention has been paid to Philadelphia, because here alone has it been possible to secure such data as are required for an intelligent study of the distribution of consumption.

It is to be hoped that, if this report contributes to nothing else, it will aid in bringing our authorities to appreciate the lamentable absence of all careful records of mortality outside of this city. Even in Pittsburgh the mortality returns, which were secured through the courtesy of Dr. W. H. Mercur, are defective in not giving reports from the individual wards, though in other respects interesting and valuable. And in not one of the smaller cities have I been able to learn that complete mortality returns are regularly printed and published. I have even been assured by my correspondents, in some cities of 50,000 to 70,000 inhabitants, that it is entirely possible for a corpse to be interred without a physician's certificate as to cause of death, and without official registry of burial.

In approaching the study of consumption in Philadelphia, several tables were prepared, which are given in the appendix. During the past twenty-six years the mortality from phthisis in this city has been about 60,000 out of a total mortality from all causes of about 400,000. The uniformity with which the rate of 14 per cent., as that of the proportion of deaths from phthisis to total mortality from all causes, is maintained year after year is remarkable.

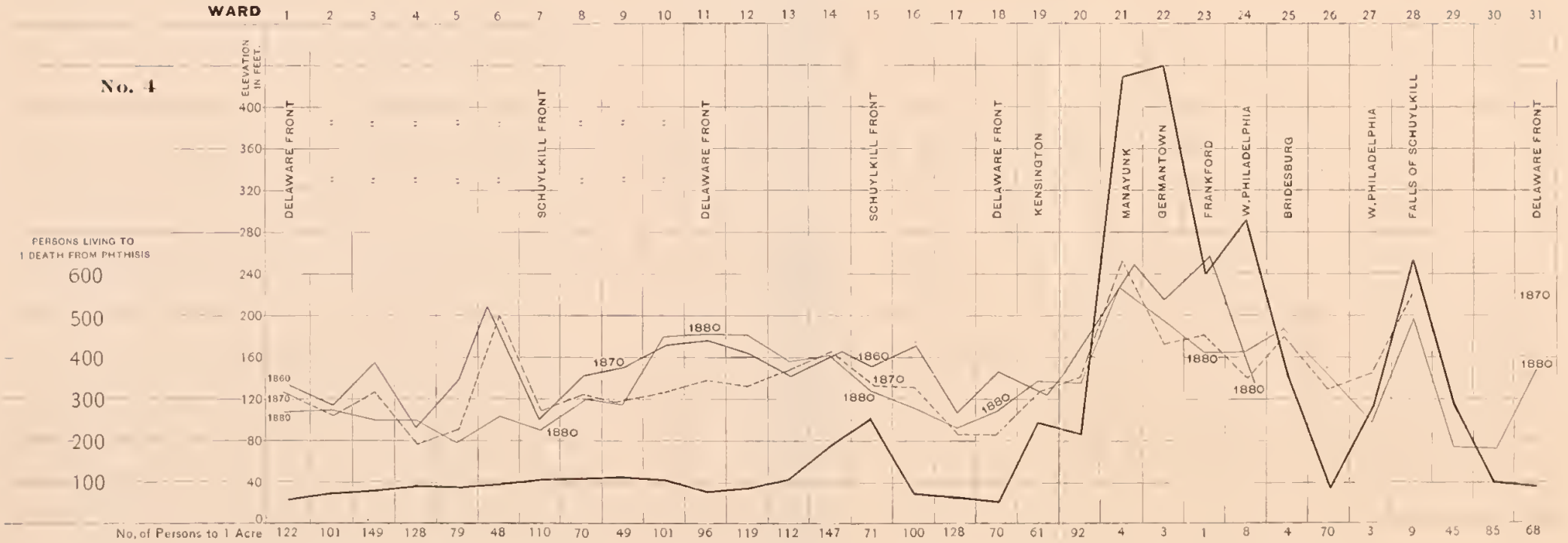
Table No. 2 shows the proportion of the deaths from consumption occurring at different periods of life.

The same excessive mortality from this disease among negroes, which is noted at every part of the State where any considerable number of this race reside, is conspicuous in the returns from Philadelphia. The total mortality of negroes from phthisis during the past twenty-four years has been 4,327, while the average annual negro population during this time, of about 25,000, would have yielded a mortality from consumption of only 1,900 deaths were the rate the same as among the rest of the community. The mortality

CHART SHOWING RELATION OF MORTALITY FROM PHTHISIS IN PHILADELPHIA TO ELEVATION AND DENSITY OF POPULATION, BY WARDS.

FOR 1860, 1870, 1880.

Designed by Guy Hinsdale, M. D.



The heaviest line shows the highest elevation of wards. The remaining lines show the number of persons living to one death from phthisis.

returns are not sufficiently minute to enable any statement to be made as to the mortality of the various individual foreign elements which contribute largely to our population. In 1880 the deaths from phthisis among the foreign-born were 1 in 266. To state the case in another way: In the foreign population the mortality from phthisis for twenty-five years has been 18,189, whereas the average death-rate from phthisis, as determined from the whole community, would have rendered 15,125 the proper total of deaths from phthisis for the foreign-born. It is evident that, if the deaths from phthisis among negroes and among the foreign-born were deducted from the total, the mortality from this cause among the white native-born citizens of Philadelphia would appear truly as being much smaller than is commonly regarded.

The deaths from phthisis among the native white population are 9·3 per cent. of the total mortality, and, excluding negroes and foreign-born, there is one death from this disease in every 506 of the population.

It has been found impossible to obtain complete statistics as regards the mortality from phthisis among the Jews, a point of considerable interest in consequence of the prevalent notion that this race is remarkably exempt from that disease. I am indebted to the kindness of Dr. Isaac Leopold for the following figures, which give the burial records for the past ten years of a Jewish cemetery and of a Jewish beneficial society. They show that, of 611 deaths, 58, or 9·5 per cent., were due to phthisis, while in the entire community the proportion is 15·4 per cent.

A chart has been prepared by Dr. Hinsdale showing the relation which the mortality from phthisis in Philadelphia in each ward, during the years 1860, 1870, and 1880, bears to elevation and density of population. The position of the wards is noted as to river frontage, rural districts, etc.

It is remarkable that the greater mortality from phthisis coincides with low elevation and greater density of population. Another table shows that the wards where phthisis is more frequent are supplied with water from the poorer pumping stations.

In an article on "Consumption in New England," by Dr. E. P. Hurd, of Newburyport, Mass., published in the "Boston Med. and Surg. Jour.," March 29, 1883, several interesting facts are brought out. In Newburyport, during twenty-five years, there has been an average population of 13,500. It is the type of an old seaport and fishing town, having a nearly stationary population of an old Ameri-

can ancestry. It is cold and chilly. During this period the deaths from phthisis were one sixth of the total mortality, or one in 285 of the population. He shows that in 1880, among those of American parentage, there was one death in 351; among those of foreign parentage, one in 136.

Dr. J. Curtis, in a study of phthisis in Boston made forty years ago, found that between 1821 and 1848 the deaths from phthisis were to total deaths as 1 : 5·76.

Hayward found that in New York city between 1820 and 1850 the ratio was 1 : 5·54, or 18 per cent. of the total mortality.

Dr. E. M. Snow found that in Providence, R. I., between 1840 and 1854 the deaths from phthisis were one in 209 of total population; between 1856 and 1881 they were 16·69 per cent. of the total mortality, or one in 317 of the total population. He also shows that in 1880, among those of American parentage, there was one death in 435; among those of foreign parentage, one in 268.

The ratio in Philadelphia in 1880 was one in 316 of the total population, which, it is to be borne in mind, is by far the worst ratio found in Pennsylvania. The deaths from phthisis are 15·4 per cent. of the total mortality.

I am also able, by the kindness of Dr. Mercur and of Dr. Snively, of Pittsburgh, to include among these statistics the very careful records of the mortality from phthisis in that city. They extend from 1875 to 1886, and show that this disease is not so frequent in Pittsburgh as it is in Philadelphia.

Calculations from these statistics show that the deaths from phthisis during eleven years were 9·2 per cent. of the total mortality. There was, in the year 1880, one death from consumption for 497 persons living. The corresponding figures for Philadelphia are 15·4 per cent. and 316 persons living for one death from phthisis.

Among the foreign-born in Pittsburgh there was one death in every 327 persons living; among the negro population there was one death for 367 persons living.

Summary of Replies from 120 Practitioners in 47 Counties of Pennsylvania.*

Berks County.—Two replies. Mohnsville; population, 500. Sheltered. West winds prevail. Air cool and damp. Fogs occur occasion-

* I take this opportunity to express anew my sense of obligation to the numerous correspondents whose valuable replies to my circulars and letters can not be adequately presented here.

ally. It is a town with many shade-trees. There are ponds, meadows, hills, and valleys. The soil is of medium quality. There is a considerable fall of temperature at night. The people are engaged in farming and in factories, and are chiefly American and German. Phthisis is rare. There has been only one death from phthisis in four years in this town. It assumes a chronic course and is hereditary. There is no malaria, and only occasionally rheumatism, pneumonia, and Bright's disease.

Reading; population, 43,278 (1880); elevation, 280 feet. Sheltered and warm. The air is warm and dry. Fogs are rare. There is not much shade outside the town, but there is abundance in the streets. No trees have been cut down for health. The rock is limestone and there are many fissures providing ready underground drainage. There are deposits of clay. There are few marshes. There are hills to the east and south. No marked changes in temperature. The population is mixed, and is engaged chiefly in factories. Consumption is moderately prevalent, and possibly more so in the newer districts. Cotton-factory employees and marble-cutters are especially prone to phthisis. The disease usually runs a chronic course. There is one death from phthisis for 389 persons living. The general death-rate is 15·8 per thousand. Phthisis is both caused and promoted by hereditary influences in the majority of cases. Malaria is prevalent, but has no relation to phthisis except as it may bring about "consumption from congestion." No prevalence of pneumonia, rheumatism, or Bright's disease.

Bucks County.—Three replies. Falls Township; elevation, 40 feet. Sheltered. Northwest and southwest winds prevail. The air is warm and dry; fogs occur. Rain-fall, 42 inches. Snow, 30–40 inches. Little shade. There are meadows. Soil, clay and gravel; of medium quality. No marked atmospheric changes. The people are of American descent and engaged in farming. Consumption is rare. There is a house where consumption has been especially prevalent; it is a stone house on a dry knoll with little shade. The disease is chronic, and the reporter's cases are in females chiefly. Seventy-five per cent. are hereditary. Malaria is prevalent, but consumption is not specially prevalent in malarial districts. Rheumatism is prevalent. Pneumonia and Bright's disease are not.

New Britain; population, 150. Sheltered. West winds prevalent. Soil very rich, sandy, and well cultivated. Northeast winds troublesome to consumptives. No great atmospheric changes. People engaged in farming and of American descent. Moderate amount of consumption. The disease is usually chronic; most cases are hereditary, the exciting cause being malaria in nearly every case. In two cases attendants contracted phthisis. Malaria is prevalent. Rheumatism, pneumonia, and Bright's disease are not.

No. 3. Point Pleasant; population, 300. In a sheltered position on the Delaware River. Fogs occur. There is abundant shade. There are hills and valleys. Soil of medium quality. East winds troublesome to consumptives. No marked atmospheric changes. The people are Ameri-

cans, Germans, and Irish, and are engaged in farming and lumbering. The disease is usually acute; it is hereditary, but skips generations; it may be propagated from husband to wife. Malaria occasional. No prevalence of pneumonia, rheumatism, or Bright's disease.

Chester County.—Five replies. Three reports from West Chester; population, 8,000; elevation, 412 feet; exposed; mean annual temperature, 50°. Northwest and southwest winds prevail. The air is dry and there are few fogs. Rain-fall, 48·4 inches. Small amount of snow. The streets are well shaded, but there are no woods near. The soil is a loam from decomposed igneous rock. There is clay. There are swamps, but the land is generally well drained; but few sewers. The soil is rich. Southeast winds are troublesome to consumptives. There is no great liability to sudden atmospheric changes. There is a great fall of temperature at night. The people are engaged in farming. Consumption is moderately prevalent. It pursues a chronic course, is hereditary, and is frequent among negroes. The reporter thinks the disease is contagious. No prevalence of malaria, rheumatism, pneumonia, and Bright's disease.

Another report from West Chester says that east winds trouble consumptives the most, and that there is no great fall of temperature at night; also that phthisis is not prevalent, but that a few houses in the country that are low and shaded seem to be particularly associated with phthisis. The reporter, Dr. Jacob Price, has known cases cured by removal to elevated western localities; he says heredity is a strong factor, and that contagion occurs; on the other hand, that liberal diet and out-of-door life may prevent the disease in children predisposed to it.

A third reporter estimates the hereditary cases at 25 per cent., says the disease is not specially prevalent, and believes in contagion.

No. 4. Unionville; elevation, 350 feet. Sheltered, warm and cold. West winds prevail. Atmosphere is variable. The soil is good and is on a Silurian and Laurentian base. There are ponds, meadows, hills, and valleys. East winds are troublesome to consumptives. There are sudden atmospheric changes. The people are engaged in farming and are of American descent. Phthisis is rare; it is chronic; hereditary in 75 per cent. No malaria. Rheumatism is prevalent. Pneumonia is not prevalent. There are a few cases of Bright's disease.

No. 5. Springfield; elevation, 557 feet. Exposed and cold. Fogs occur. It is not shaded. Soil is good and is clayey. Marked changes in temperature. Occupations are farming and mining. Consumption is rare. No part of town or house is liable. The disease is both acute and chronic. East winds trouble consumptives. Ninety-five per cent. due to heredity. Children can be protected by good hygiene. No evidence in support of infection. No malaria. Little rheumatism and pneumonia or Bright's disease.

Erie County.—Erie; population, 27,730; elevation, 573 feet. One annual death from phthisis in 433 inhabitants. Situation exposed. Mean annual rain-fall, 42 inches. Mean annual temperature, 49·3°.

Franklin County.—Three replies. No. 1. Greencastle. Consumption is rare. In over 1,200 patients the reporter has only 15 cases of phthisis, 3 of which had hereditary taint. No part of his town peculiarly liable to the disease. The employment is farming. Americans and negroes, with a few Irish and Germans, suffer. No particular houses are afflicted, unless in cases of decided humidity. Course is always chronic in his practice. Phthisis is hereditary, but in 20 per cent. of his cases (three cases) there was no heredity, the cases occurring in girls at puberty. He states that disordered menstruation is the most common cause of the disease where no heredity exists. He has never seen the disease in males without heredity. He has never seen it prevented, and knows of no reason for believing it to be contagious. Malaria is not prevalent. Rheumatism is quite prevalent. Pneumonia not prevalent, nor Bright's disease.

No. 2 writes from Upton; population, 165; elevation, 693 feet. It lies in an exposed, cold situation. Atmospheric changes are great. Employments are agricultural and mechanical. Citizens are Americans for several generations. Consumption is rare, and no part of town is peculiarly liable. There is one house in which a whole family have died from this malady, hereditary influences and other unsanitary causes being present. Consumption does not affect any class or nationality in particular, and the disease is as often acute as chronic. No cases have been affected by going from or coming to the town. Fifty per cent. of cases are due to heredity. Reporter has no doubt that children with hereditary influence can be saved by hygienic precautions. Has no evidence as to infectiousness. No prevalence of malaria. Rheumatism is frequent. Pneumonia not very frequent. No prevalence of Bright's disease.

No. 3. Chambersburg; population, 9,000; elevation, 605 feet. Sheltered; temperature moderate. Northwest winds prevail. Air signally moist; not foggy. Limestone. Soil good. Phthisis not very prevalent. Not liable to sudden changes from heat to cold. Trades, factories and farming. Americans, Germans, and negroes form the population. No part of town is peculiarly liable. There have been particular houses afflicted; hereditary influence present; surroundings good. The disease occurs most in negroes and mulattoes, and among these is very fatal and rapid. Runs chronic course in whites; acute in negroes. Patients have had hæmorrhages here, have gone to Colorado, and have recovered; on returning, been ill again; but, on going West, have recovered. Seventy-five per cent. due to heredity. Can be prevented by hygienic measures. *Has plenty of evidence of infection.* Thinks it much more frequently contagious than is generally believed. No prevalence of malaria, rheumatism, or pneumonia.

No. 4. St. Thomas; population, 550; elevation, 800 feet. Town is dry. No sudden changes from heat to cold. People farmers; of American descent for several generations. Consumption is prevalent. No parts of town or houses are peculiarly liable. It is not more prevalent in one

race than another. It runs a chronic course. No cases have been caused by coming to town. It is promoted by hereditary influence. No prevalence of malaria, rheumatism, pneumonia, or Bright's disease.

Fulton County.—No replies.

Lehigh County.—No replies.

Mifflin County.—Four replies. No. 1. Milroy; population, 750; elevation, 600 feet. Town is exposed and cool; is liable to sudden changes in temperature. The air is cool and damp. Fogs seldom occur. Agriculture and mining, factories and lumbering, are the pursuits. Germans and Irish form the population. Consumption is very rare. No part of town is liable particularly. Phthisis runs an acute course; "but few cases have occurred in many years." No cases of the disease have been cured or made worse by coming to this town. Milroy is located at the foot of the Seven Mountains, on the south side of the mountains and east end of Kishicoquillas Valley. The ground or soil on which it is built is all of made earth or wash from the mountains, to a depth of an average of twenty feet—the greatest depth is about forty feet—and of mountain soil, sand and pebbles, with large bowlders. There are caverns. There is a mountain stream of considerable size flowing rapidly through the town, and sinking under a limestone ridge near the center of the town, making its appearance again in a much larger stream two miles south of Milroy. I have been informed that one entire family, except one member, a female about forty years of age, died of consumption. The family consisted of father, mother, four daughters, and one son. Another family consisted of father, mother, four daughters, and three sons. Three of the daughters died of consumption. There was, in my opinion, nothing to indicate hereditary disease in either case. "I have not seen any cases of hereditary influence in twenty years, or since my sojourn here."

In a practice of over forty years has seen cases prevented by proper diet and regimen, cod-liver oil, iron, etc. No proof of infection. No malaria, pneumonia, rheumatism, or Bright's disease.

No. 2. Lewistown; population, 4,000; elevation, 800 feet. Not exposed. Disease is not prevalent. There are often rapid changes from heat to cold. Soil alluvial; limestone. Has had but six cases in large practice in a year. Negroes are most often affected. Phthisis is not prevalent, and no part of the town or houses peculiarly liable to its prevalence. It runs a chronic course generally, and is promoted by heredity. The reporter has never seen any case benefited by going from or coming here, but believes that the disease can be prevented in childhood by hygienic measures. No evidence that it is contagious. Malaria is slightly prevalent in autumn.

Twenty-six, 27, and 28, negative answers.

No. 3. Newton Hamilton. Town sheltered and cold. South and west winds prevail. Air is cool and damp and foggy. Much shade. Town liable to sudden changes of temperature. Occupation, farming. Phthisis prevalent. No part of town is liable. He knows of a house peculiarly

liable, where there is hereditary influence. No race particularly liable. Phthisis almost always promoted by heredity. No evidence as to infection. Malaria is very prevalent. Twenty-six, 27, and 28, negatively answered.

No. 4. McVeytown; population, 700; elevation, 522 feet. Exposed. On the Juniata River. Soil alluvial; clay. Not liable to sudden changes of temperature except in summer. Fogs from August to November. Population, Americans and a few negroes. Consumption is rare. No part of town or any house is liable. Phthisis is somewhat prevalent among negroes. Runs chronic course. All cases are inherited. Can be prevented by hygienic measures. No evidence in support of contagion. Malaria is prevalent. No relation to phthisis. Rheumatism, both acute and chronic, is prevalent. Pneumonia and Bright's disease not prevalent.

Philadelphia: One reply from Conshohocken; population, 5,000; elevation, 210 feet. Town is exposed and cold; fogs sometimes occur. There is not too much shade. The town is not subject to sudden changes. People work in factories. All nationalities represented. Phthisis not prevalent. Occurs most frequently among Irish. The disease is unquestionably promoted by heredity. The reporter, Dr. Styles, has known the disease to occur in wives who have nursed sick husbands, no heredity or family history accounting for the disease, which proved fatal in wives after the death of husbands.

Malaria is prevalent, but bears no relation to phthisis. Rheumatism, pneumonia, and Bright's disease are all prevalent.

Washington County.—One reply. Monongahela City; population, 3,000; elevation, 749 feet. Sheltered. East and west winds prevail. In winter and spring there is much damp weather, with heavy fogs in winter and late autumn. There are sudden and extreme changes of temperature; in summer the mercury often reaches 98°, and in winter —18° F. There is a medium amount of rain and snow. There is shade in the streets; trees should be cut down. Soil alluvial and good. East winds troublesome to consumptives. The people are engaged in farming, factories, and mining; they are of American descent, mining population, mixed. Phthisis is said to be "not prevalent to any great extent, and yet we have quite a number of cases, chiefly hereditary." No part of the town and no house and no race are associated particularly with phthisis. This disease runs a chronic course. The reporter, Dr. C. B. Wood, says: "Some cases have been benefited by going to the Pacific coast; others to Texas; others to the Northwest. None benefited by coming here; on the contrary, I think it an injury to them." In ten years Dr. Wood has met with but one acquired case, and he believes that incipient phthisis can be cured or prevented by out-door life, keeping away from school, proper diet, ventilation, and medicine. Dr. Wood is a firm believer in the contagious nature of consumption, and offers four cases in proof. Malaria and Bright's disease are not prevalent; rheumatism and pneumonia are.

N. B.—The returns as given in the census from this county are so much at variance with those from neighboring counties that there is almost certain and flagrant inaccuracy. The report gives 92 deaths from consumption among females and only 40 among males.

Adams County.—No. 1. Dr. Pearson writes: "York Sulphur Springs is situated in the northern part of Adams County, at the foot of a mountain-range, in what may be called a rolling country. It is about 800 feet above sea level, with a population of about four hundred, and is protected on the north and west by the foot-hills of South Mountain. I have practiced here since 1850. My practice takes in a scope of ten or fifteen miles in Adams, York, and Cumberland Counties, and includes both mountain and valley. Forty years ago the country was heavily timbered. Since then much of the timber has been cleared away, land and buildings improved, and inhabitants live much more comfortably than years ago. And, as a result of these improvements, *diseases of all kinds have diminished.* Although not more subject to consumption than other localities, I have found it to prevail alike in mountain and valley. Our population is mainly native-born, descendants of German and Scotch-Irish, so that I have had no opportunity of observing the disease in different race or nationality, but do not think there would be any material difference.

"I can hardly say that consumption is a prevalent disease. Yet it is seldom that there are no cases in the country. I have not found it to prevail in any particular house or any particular locality, but affecting the poor and affluent alike in mountain and vale. The great majority of cases are undoubtedly hereditary. I have known whole families carried off by it.

"Hereditary cases are generally considered chronic, and run their course very slowly, while cases not hereditary are acute, and are called by country people 'galloping consumption.' One prolific cause of the disease when not hereditary is neglected amenorrhœa among young females.

"I have met with no case of prevention of the disease when hereditary; it may be baffled, and life and health prolonged, but will almost invariably make its appearance at some time, and such cases are generally rapid in their course.

"I have found the most satisfactory results as a prevention in the young from the use of the hypophosphites, with cod-liver oil, malt, and like remedies.

"I have not met with any reliable evidence of the disease being contagious or infectious. Cases have occurred where, the husband or wife having died of consumption, the survivor soon followed from the same cause. But in these cases there was as much probability of a hereditary tendency as of contagion.

"I have not found malaria to have much influence on the disease, but,

our country not being a malarial one, I have not had much opportunity to determine.

"I have known of no cases that were benefited by coming into or leaving this locality.

"Rheumatism is not very prevalent, but prevails to some extent in damp or very changeable seasons.

"Pneumonia prevails to some extent during winter and spring, is mostly caused by exposure and sudden changes of temperature from damp to cold, and *is a fruitful cause of acute consumption.* Bright's disease is becoming quite prevalent."

No. 2. Two reports from Gettysburg; population, 3,100; elevation, 545 feet. On a knoll between two ridges. Rather sheltered but dry, with a moderate amount of shade in town. Few fogs. Soil red shale; good. South and northeast winds troublesome to consumptives. Phthisis is *rare*, and no part of the town suffers more than another. No houses in particular suffer. Phthisis is catarrhal and acute. A very small percentage of cases is due to heredity. It can be warded off by plenty of good food, etc. No evidence in support of infection. No malaria. Pneumonia and rheumatism moderately frequent. Bright's disease very rare.

Dr. J. W. C. O'Neal does not seem to think consumption at all rare. He speaks of one house, the cellar of which was in bad condition, where there were many cases of phthisis. There was heredity, and the habits of the people were sedentary.

The disease is most prevalent among Americans, and runs a chronic course. Is hereditary, and arises frequently from pneumonia. Children can be saved by hygienic measures. It is not contagious. No malaria; 26, 27, and 28 negative.

No. 4. Bonneauville; population, 118. The disease is rare. In spring and fall, town is cold and damp, with rapid and great changes in temperature. Farming. American descent for several generations. Where the disease has been in any particular house or part of town it has been due to heredity. It is most prevalent among those of German descent. It runs a chronic course. All reporter's cases have hereditary taint. Much can be done for such children by guarding them carefully. Reporter has evidence of infection. Malaria is not prevalent. Rheumatism is common in spring and autumn. Pneumonia common. Bright's disease is not prevalent.

No. 5. McKnightstown; population, 160; elevation, 600 feet. Is exposed and cold, with infrequent fogs and west winds prevalent. The disease is prevalent, but no part of the town suffers more than another. Dr. Elderdice speaks of a house where the conditions are good, where there is hereditary influence, and where phthisis has been frequent. It is not particularly prevalent in any race. It runs an acute course. About sixty per cent. of cases are due to heredity. Prevention is possible in children. Dr. Elderdice considers it contagious in many cases.

Malaria is prevalent, and consumption is also in malarial districts. Rheumatism and pneumonia are prevalent. Bright's disease is not.

No. 6. Littlestown; population, 1,000; elevation, 700 feet. Is exposed, with occasional fogs. Farming is the general employment, all citizens being of American descent. Consumption is rare. No portion of town or any house seems to be particularly associated with phthisis. It runs an acute course, and is promoted by heredity. Dr. Seiss does not believe it can be prevented in children predisposed. He has evidence in support of infection. No prevalence of malaria, rheumatism, pneumonia, or Bright's disease.

Alleghany County.—See Pittsburgh.

Armstrong County.—Two replies. No. 1. Kittanning; population, 1,800; elevation, 809 feet. Sheltered. Fogs seldom occur. Medium amount of snow. Not too much shade. Soil good. East winds troublesome to consumptives. No great atmospheric changes. Citizens engaged in mills, etc. Moderate amount of consumption. There are some cases of heredity. The disease is usually chronic and hereditary. The reporter, Dr. Alter, says that in one instance a perfectly healthy wife nursed a husband for six months; after his death she had a cough and slight hæmorrhage, but recovered. Another wife died within a year after her husband had died from phthisis. No hereditary tendency in either case. No prevalence of malaria, rheumatism, pneumonia, or Bright's disease.

No. 2. Worthington; population, 150; elevation, 1,100 feet. Sheltered, but cold. No excess of shade. Great changes in temperature. The occupations are farming, factories, and mining. American descent, with Germans and Irish. The disease is rare. No part of town or any house peculiarly liable. No nationality in particular suffers. The disease runs a chronic course. All cases are hereditary. Children may escape through care. No prevalence of malaria, rheumatism, or Bright's disease. Pneumonia is prevalent.

Dr. John K. Maxwell says: "I have for forty years believed that I have seen evidence of the contagiousness of this disease. The wife of a consumptive husband, or the husband of a consumptive wife, almost invariably dies of consumption, although belonging to healthy families themselves. I am unable to say whether this is owing to contagion or infection, but in a long experience I can recall but two exceptions to the rule, in both of which apoplexy was the cause of death."

Beaver County.—One reply. Beaver Falls; population, 8,000; elevation, 600 feet. The town is sheltered by high, wooded hills. West winds prevail. The air is damp and fogs prevail. Soil gravel. Southeast winds troublesome to consumptives. There are marked changes of temperature. Population mixed; engaged in factories. Grinders and polishers are prone to phthisis. The disease is chronic and hereditary. Persons have been cured by going away to a warm, dry climate. There is some malaria. Rheumatism is rather prevalent. Pneumonia prevails

during some winter seasons more than others. Bright's disease is not especially prevalent.

Bedford County.—One reply. Bedford; population, 3,000; elevation, 1,200 feet. Sheltered, but cold. Fogs occur. Much shade. No trees cut for health. Liable to sudden changes—heat and cold. Lumbering, farming, and manufacturing are the occupations. All nationalities represented. Consumption is prevalent. No spot in town particularly liable. There are houses particularly liable. No occupation exempt from disease. Most common among Americans and negroes. Seventy-five per cent. are due to heredity. Runs both acute and chronic course, generally the latter. Children can be saved by strict regularity in food and clothing. No malaria. Rheumatism and pneumonia common, and prevalence of Bright's disease.

Bradford County.—Three replies. No. 1. Terrytown; population, 2,000; elevation, 600 feet. The air is cool at night; warm by day. Damp by reason of frequent fogs along the Susquehanna. Westerly winds prevail. Southeast winds are troublesome to consumptives. Soil good. Sudden changes of temperature are quite common. Farming and mining are the occupations. Inhabitants largely New Englanders. Consumption is rather rare; it is more common along the river, where malaria prevails; phthisis is chronic, lasting from two to twenty years, and affects all classes alike. In a practice of over fifty-five years Dr. George F. Norton finds that over fifty per cent. of cases are constitutional and hereditary. He does not believe that hereditarily predisposed children can be rescued from phthisis, but its advent may be postponed. He believes in contagion. Malaria is very prevalent along the river. Neither rheumatism nor pneumonia is prevalent, and Bright's disease has not been met with.

No. 2. Athens; population, 3,000; elevation, 750 feet. Sheltered by hills. Warm in summer, cold in winter. Damp, with dense fogs. Considerable shade in town; too much in places. Soil rich. South winds bad for consumptives. Occupations farming, mining, etc. Consumption is rather rare. One house, where heredity was present, was associated with phthisis. More frequent among Irish than Americans; more frequent still among negroes. Some cases are acute, others chronic; most cases are acute. It is due to heredity in seventy-five per cent. of cases. It can be prevented by hygienic measures. Has evidence in support of infection. Malaria common. Rheumatism is frequent, also pneumonia. Bright's disease rare.

Dr. E. P. Allen, who has practiced over forty years, writes:

"I have seen a few cases where the husband died of consumption and the wife's death followed in a few years, from three to five, and could trace no hereditary influence to attribute the disease.

"I have known a father, two daughters, wife, three sons, comprising every member of family, to die of consumption, though from the death of the father to the death of last member of family was thirty-eight years. Another family, consisting of five sons and two daughters, all of

whom died in a period of twenty-three years. The father did not die of consumption, but from an injury on head, several years prior to death of first child. The mother is still living and healthy. Heredity on side of father. A number of other cases might be reported quite as strong. No unsanitary conditions about houses or premises could be detected, such as shade from trees or dampness. Both families lived on farms on dry and elevated land.

"Malaria made its appearance about eight years since, after an absence of fifty or sixty years, when it is said to have been quite prevalent. It has been declining the past three years, and is now rarely seen, though the word malaria is often improperly applied to sickness. Consumption is not very prevalent in the malarial district.

"Rheumatism is rather a frequent disease.

"Pneumonia may prevail at all seasons of the year among us, but it is far more frequent and fatal during the months of March and April than at any other period of the year. Its victims are mostly active business men past forty years of age.

"Bright's disease occurs now and then, but it is not a frequent disease."

No. 3. Troy; population, 1,500; elevation, 1,148 feet. Sheltered by mountains. North, south, and west winds prevail; east winds rare. Fogs rare. Soil good; subsoil, clay. Few marshes. The population is American, German, and Irish, and is engaged chiefly in farming and lumbering.

Consumption rare and chronic; cases of phthisis cured by removal to this county. Phthisis always hereditary. No malaria. Rheumatism, pneumonia, and Bright's disease prevalent.

Dr. Dare writes that Bradford County is damper than Sullivan, Tioga, and Potter Counties, owing to retention of water in clay subsoil. Fogs prevail along the valleys, and especially the Susquehanna. Dr. Dare speaks of a family of Smithfield, near Troy, of which all the children have died of consumption. The house is on an elevated ridge, "but damp in consequence of the clay subsoil."

Dr. Dare's own case is an instance of the benefit of removal to Bradford County. He resided in Chester, Delaware County, in 1857, was then thirty-five years of age, and had pulmonary hæmorrhage, being the only survivor of six children, all but one having died of consumption between the twentieth and thirty-fifth year. The family lived in Cumberland County, N. J. "After being prostrated one year I came to Troy, Bradford County, Pa. Since then I have had but one hæmorrhage, which occurred the following summer, and since that time I have been perfectly well." "The other members of my family were all attacked with pulmonary hæmorrhage as I was, and died in about one year after. I can see no reason, if I had remained in that section of the country, why I would have fared any differently."

Butler County.—No reply.

Cambria County.—Two replies from Johnstown; population, 2,500; elevation, 1,200 feet. The town is sheltered and comparatively warm. Northwest winds prevail. The air is cool and damp, and there are sudden changes of temperature. There are high hills. Soil is of medium quality. Consumption is said to run a chronic course, and, in a majority of cases, is hereditary. No prevalence of malaria, but rheumatism, pneumonia, and Bright's disease prevail.

No. 2 says there are fogs in the autumn. There is much shade, and there are sudden changes from heat to cold. Mills and mines occupy citizens, who are German, Irish, English, and Pennsylvania Dutch. Phthisis is *rare*. No part of town liable, nor any house. It runs an acute course. Not entirely due to heredity. No evidence in support of infection. No malaria. No prevalence of rheumatism, pneumonia, or Bright's disease.

Carbon County.—One reply. Weatherly; population, 3,000; elevation, 1,200 to 1,500 feet. The town is sheltered and cold. East and west winds prevail. Air cool. Fogs occasional. There is a great deal of snow. Not much shade. Hills and valleys. Sudden changes of temperature. People of American descent, Irish, and Germans, engaged in manufacturing. Consumption rare. No part of the town and no race liable to the prevalence of consumption. Disease chronic and hereditary. Malaria not prevalent. Rheumatism and pneumonia are prevalent, and there are some cases of Bright's disease.

Centre County.—Three replies. Two (Phillipsburg and Zion) state that phthisis is rare; one (Bellefonte) that it is moderately rare, not prevalent. The latter town has a population of 3,200; it is said to be in a sheltered but cold situation, liable to sudden changes of temperature and occasional fogs. Elevation, 733 feet. No particular parts of the town or individual houses are especially associated with phthisis. The course of phthisis is chronic, and the disease is hereditary excepting in the cases of axe-grinders. Rheumatism is moderately prevalent. Malaria, pneumonia, and Bright's disease rare.

No. 2. Phillipsburg, 28 miles west of Bellefonte, has a population of 5,000, and an elevation of 1,450–1,500 feet. It is in a valley sheltered by hills, and is warmer than the surrounding country; dry; free from fogs. Phthisis always takes a chronic course. Malaria was traced in three instances to a local, temporary cause—the plowing of swampy ground. Many cases of malaria were cured by residence in this county.

Rheumatism, pneumonia, and Bright's disease uncommon.

No. 3. Zion; population, 100; elevation, 883 feet. Exposed and cold; northwest winds prevail; fogs are rare; changes of temperature are marked. Phthisis is hereditary in 75 per cent., chronic, and frequent in axe-grinders. Rheumatism and pneumonia are prevalent; Bright's disease rare.

Farming, mining, and lumbering are carried on in this county.

Columbia County.—One reply. Catawissa; population, 2,400; ele-

vation, 477 feet; sheltered; northwest winds prevail. The air is damp and cold and there are fogs; rain-fall and melted snow, 39 inches; snow, 50 inches. There is a great deal of shade, and trees have been cut down for health. Soil very rich. East winds troublesome to consumptives. Marked atmospheric changes. People engaged on farms and railroads—Americans, Germans, and Irish. Consumption is rare and chronic; hereditary in 75 per cent. of cases. Malaria is prevalent, but phthisis is not prevalent in malarial districts. Rheumatism prevails; pneumonia and Bright's disease do not prevail.

Crawford County.—Two replies from Titusville. Population, 8,000; elevation, 1,194 feet. Town sheltered and is warmer than the hills about it. Both reports state that the atmosphere is damp, that sudden changes of temperature occur, and that there are some fogs. One report states that east and north winds are the more troublesome to consumptive patients, and that the disease is more frequently acute, with no evidence of infection; the other report states that southwest winds are the more troublesome, and that the disease is usually chronic and that there is presumptive evidence to prove infection, all of which goes to show that doctors will occasionally disagree. Consumption is not infrequent; rheumatism is prevalent; pneumonia and Bright's disease occasional. Trees have been cut down in the streets. All occupations exist and all nationalities are represented. The Swedes are prone to die of phthisis; the Jews rarely.

Cumberland County.—Two replies. Both agree as to the prevalence of consumption and its chronic course, that easterly winds are the more troublesome in this disease, and that the large majority of cases are hereditary. Rheumatism is prevalent.

No. 1. Shippensburg; population, 3,000; elevation, 660 feet. Some shade-trees have been cut down; the atmosphere is damp and fogs occur. Great changes of temperature occur, and there is a marked difference between the temperature at noon and night. The industries are diversified. The people are chiefly of American descent; negroes are numerous. Pneumonia is prevalent and Bright's disease prevails to some extent.

No. 2. Newville; population, 1,900; elevation, 526 feet. The town is exposed and cold, but dry and free from fogs. The underlying rock is limestone and slate, and farming is the chief occupation. The people are largely of Scotch-Irish descent. Negroes and Indians (Carlisle), having once contracted phthisis, rapidly succumb.

For further information see letters of Dr. John J. Koser, Dr. W. G. Stewart, and the Rev. J. B. Scouller.

Dauphin County.—No reply.

Delaware County.—Two replies. No. 1. Media. Consumption rather prevalent. Soil red; a clayey loam. All nationalities represented. Occupation farming. Elevation low. Fogs occasional. Malaria and rheumatism rare. Pneumonia frequent in winter. Bright's disease infrequent.

No. 2. Clifton Heights; elevation, 154 feet. Sheltered. Drained by Darby Creek and Ridley Creek. Country undulating. Soil good. Manufactories. Phthisis somewhat prevalent. In one house one sister and four brothers died of consumption. They all passed the age of thirty-five years. Course slow. Hereditary history. Roomy frame house, dry, on elevated ground; grove on the south. Irish children predisposed, from being put at work in factories at an early age. Here the course of the disease is quite rapid. Hereditary in 90 per cent. Reporter thinks the disease may be prevented to some extent. Malaria near brick-yard. No prevalence of rheumatism, pneumonia, or Bright's disease.

Q. No. 24. A man and wife lived together for twenty-five or thirty years and reared a large family of children. At the age of forty-eight years the wife had her first attack of hæmorrhage of the lungs and developed well-marked consumption. At that time the husband was a stout, ruddy-faced Irishman, apparently in perfect health. In the course of a year he became consumptive and died before the wife. One son has since died of the same disease.

No. 3. Upland; population, 2,500; near the Delaware River. Fogs are frequent. There is a good deal of shade. Many cellars have water a large part of the year. Soil clayey. East and northeast winds troublesome in consumption. Consumption not very prevalent; occasionally hereditary and generally chronic. Cases have been cured by removal to Georgia pine-lands and to Maryland. Malaria is more or less prevalent, but bears no relation to phthisis. Rheumatism, neuralgia, bronchitis, and pleurisy are common.

Fayette County.—Five replies. All report phthisis prevalent. In no place is there a report of excessive shade. The population is mixed and engaged in farming, coal-mining, and manufactures.

No. 1. Uniontown; population, 5,000; elevation, 950 feet. Exposed; cold. Southeast and northwest winds prevail. There is not much fog; the air is cool and damp. Limestone. Soil good. Northwest winds troublesome to consumptives. Considerable changes of temperature. Phthisis chronic. Americans and negroes affected. Hereditary. Rheumatism and pneumonia prevalent, Bright's disease not; no malaria.

No. 2. Brownsville; population, 4,200; elevation, 774 feet. Sheltered. West winds prevail. Fogs rise from Monongahela River in spring and autumn. Average rain-fall, nine years, 36·07 inches. Limestone; clayey loam. No ponds or marshes. Good drainage. Rich soil. East winds troublesome to consumptives. Reporter says phthisis is "more rare among negroes than any other class." Phthisis both acute and chronic. Two cases have apparently been cured by going to California and one to Colorado. Reporter believes in infection. Malaria and pneumonia not prevalent. Rheumatism and Bright's disease are prevalent.

No. 3. New Haven; population, 1,000; elevation, 920 feet. Sheltered and warm. Westerly winds prevail. Fogs occur in the spring and autumn. At other times the air is dry. Southeasterly winds most

troublesome to consumptives. Great atmospheric changes. Americans and negroes suffer. Disease chronic and acute. Cases have been cured by removal to our mountains or going West. Hereditary in 60 per cent. No malaria. Catarrhal pneumonia prevalent; croupous rare. Bright's disease rare; rheumatism prevalent.

No. 4. Vanderbilt; population, 1,000; elevation, 1,200 feet Sheltered and warm; in a valley. Soil good. Northeast winds troublesome to consumptives. Phthisis chronic. Malaria, rheumatism, and Bright's disease not prevalent. Catarrhal pneumonia prevalent.

No. 5. Dunbar; elevation, 995 feet; sheltered north and west. Cool, dry; no fogs. South winds troublesome to consumptives. Marked changes of temperature. One house particularly associated with phthisis; it is damp and shady. Americans chiefly affected. The disease is usually acute. Reporter has evidence in favor of infection. Malaria, pneumonia, and Bright's disease not prevalent. Rheumatism prevails.

Huntingdon County.—One reply. Orbisonia; population, 1,100; elevation, 750 feet. Consumption occasional. The town is exposed and cold. West and southwest winds prevail; the former are the more troublesome to consumptive patients. The air is cool and damp, and fogs and sudden changes of temperature occur. There are some ponds. The soil is of medium quality; farming and mining are the chief pursuits. The people are for the most part Americans. Phthisis runs an acute course, and about half of the number of cases are said to be hereditary. No malaria or Bright's disease. Rheumatism is prevalent. Pneumonia moderately so.

Jefferson County.—No reply.

Juniata County.—No reply.

Lackawanna County.—Two replies from Scranton. Population, 70,000; elevation, about 750 feet. Mortality from phthisis 7·33 per cent. of total mortality. No fogs. Sudden changes of temperature. All nationalities represented; engaged chiefly in factories and mining. One reporter thinks phthisis is usually chronic and believed to be acquired, though hereditation has been noticed by the second, and his cases are acute. One reporter instances a case where a healthy wife was infected by a diseased husband. No malaria. Rheumatism, pneumonia, and Bright's disease are prevalent.

Lancaster County.—Seven replies. One refers to consumption as very rare; two say it is rare; two, rather rare; one, prevalent to a limited extent; one, rather frequent. All excepting one (Manheim) describe their towns as exposed. The land is rich; the people are occupied in farming, are thrifty, and largely of German descent. Easterly winds are uniformly recognized as most troublesome to consumptive patients. Rheumatism prevails and malaria is not infrequent, excepting, of course, in Paradise, where the reporter not only states that consumption is rare, but denies the prevalence of rheumatism, pneumonia, Bright's disease, and says there is no malaria.

No. 1. Ephrata; population, 1,500. Situated on the north side of Ephrata Mountain, 384 feet above tide. In eleven years' practice the reporter found no cases of acquired phthisis, and states that the few inherited cases he has met with have moved there from other places. Rheumatism and neuralgia prevail owing to change of temperature.

No. 2. Bird-in-Hand; population, 350; elevation, 359 feet. The air is cool and damp, and there are occasional fogs; there is a liability to sudden changes of temperature. Phthisis is more common among Americans and runs an acute course. Half of the cases are hereditary, and the reporter believes the disease to be contagious. There are no houses, and there is no portion of the town, where the disease especially prevails.

Nos. 3, 4, and 5. Bainbridge; population, 669; elevation, 271 feet. The streets are well shaded; the atmosphere is spoken of as warm and dry, and few fogs occur. No unusual changes of temperature are spoken of by any of the observers. One says that all the cases are hereditary; the second that 80 per cent. are so; the third says that half are hereditary; all agree that the disease is chronic, and do not believe that it is infectious.

No. 6. Manheim; population, 2,000; elevation, 402 feet. Town sheltered and warm. It has been necessary to cut down trees for health. There are some ponds and marshes. Phthisisis both acute and chronic. It is hereditary and sometimes contagious; the reporter has strong evidence of this.

Malaria prevails to a limited extent, as well as rheumatism and pneumonia. Bright's disease occasional.

No. 7. Paradise; population, 110; elevation, 359 feet. Fogs occur occasionally. The town is not liable to sudden changes of temperature. The reporter does not believe the disease can be prevented in children hereditarily predisposed. He has treated but two patients in seven years —one, aged five years; the other, aged six years and a half. Both were females living within half a mile of each other at the base of a mountain. Neither family was strumous.

Lawrence County.—No report.

Lebanon County.—One reply. Lebanon; elevation, 466 feet. Sheltered. South and east winds prevail. The air is cool and dry. Fogs do not occur often. There is shade in the streets, and trees should be removed. Limestone. The soil is very rich. East winds are troublesome to consumptives. There are great atmospheric changes. The people are engaged in factories; they are of American descent and German. Consumption is prevalent. There are houses in which consumption has been especially frequent. They are damp, but hereditary influence is present. There are private sewers with drainage into underground fissures. Consumption is generally chronic, and is hereditary in one half the cases. Malaria is not prevalent to any degree, and has no relation to phthisis. Rheumatism and pneumonia are prevalent. Bright's disease is not.

Mercer County.—Two replies. In neither place is malaria, rheumatism, pneumonia, or Bright's disease prevalent.

No. 1. Sharpsville; population, 1,819; elevation, 948 feet. The town is exposed and cold. North and east winds prevail. The atmosphere is damp. Fogs occur. The soil is good, being largely alluvial. Sandstone. South winds trouble consumptives. The people are employed in iron manufacturing, among whom are German and Irish. Consumption is said not to be very prevalent, and pursues a chronic course. It is hereditary in about half the cases. The reporter thinks that children hereditarily predisposed can be rescued from phthisis by removal to a dry and equable climate of high elevation.

No. 2. Sharon; population, 7,000; elevation, 950 to 1,150 feet. It is sheltered in a deep valley and warm. North and west winds prevail. The atmosphere is cool and damp. Fogs seldom occur. Few streets shaded. The country is hilly. Northerly winds are the most troublesome to consumptives. The town is liable to extreme changes of temperature. The people, mostly Irish with some Germans and fewer Americans, are engaged in the iron industry. Consumption is rare; when it does occur it is chronic. The disease is generally hereditary, but occasionally acquired. One patient from Sharon has been cured by going to Colorado. Malaria is very prevalent; it is thought to act as a preventive rather than as a cause. Neither rheumatism, pneumonia, nor Bright's disease can be said to be prevalent.

Mercer, the county-seat, having in 1870 a population of a little more than one fourth that of Sharon, furnished about *the same* number of fatal cases of phthisis. It is said to be a well-known fact in the county that consumption is more prevalent in Mercer than in Sharon. The town is fourteen miles east of Sharon, situated on the top of a hill 450 feet above Sharon. The wind sweeps the town. The population of the former is largely native American; Sharon, largely foreign. The reporter (Dr. E. Griswold) inclines to the opinion that the general use of bituminous coal as a fuel and for manufacturing purposes secures a certain degree of immunity from phthisis.

Monroe County.—No report.

Montgomery County.—Three replies. No. 1. Merion Square; population, 500; elevation, 600 feet. The town is exposed and cold. North and west winds prevail. The atmosphere is cool and dry. East winds are the most troublesome to consumptive patients. There are sudden changes of temperature. The people are of American descent for several generations, and there are many Irish; they engage in farming chiefly. Consumption is seldom met with; it assumes a chronic course. Seventy-five per cent of the cases are reckoned as hereditary. Reporter does not believe in contagion. No prevalence of malaria, rheumatism, pneumonia, or Bright's disease.

As to a house especially associated with phthisis, and notes as to preventive treatment, see Dr. H. A. Arnold's letter.

No. 2. Bryn Mawr. There is a large "floating" population. It is a fashionable resort ten miles from Philadelphia. Elevation at railroad station 416 feet above the sea. The place may be said to be moderately cold and exposed. The prevailing winds are southerly in summer and from the northwest in winter. East winds disturb those subject to phthisis. There are no fogs. The air is cool and dry. The country is hilly. The soil is dry and of micaceous schist. East winds are the most troublesome to consumptive patients. There are sudden changes from heat to cold. There are Americans, Hiberno-Americans, and Irish. Consumption is rather rare. The report says that if any portions of the town are liable to the prevalence of phthisis it is the lower parts along the streams. Phthisis is hereditary in probably nine tenths of the cases, and is generally chronic. The reporter, Dr. Sargent, believes that by cleanliness, fresh air, good food, daily exercise, cool sleeping apartments, cool bathing, and frictions, the disease may be prevented in children hereditarily predisposed, and that there may be contagion by neglect of the above measures. There is a slight amount of malaria. Rheumatism is moderately prevalent; so is pneumonia. Bright's disease is not prevalent.

No. 3. Perkiomen; population, 2,515. The town is partly exposed, partly sheltered. West winds prevail. The air is cool and dry, except in valleys where there are streams; there it is foggy. Woods scanty. The soil is good; red shale. The people are engaged in farming. Consumption is chronic. Of the total deaths, about 16 per cent. occurred from phthisis and intercurrent pneumonia. The reporter thinks that malaria acts as an exciting cause in those predisposed to phthisis. No prevalence of rheumatism, pneumonia, or Bright's disease.

Northampton County.—Two replies. No. 1. Easton; population, 11,924 (1880). The principal part of the town is 190 feet above tide, a portion is from 290 to 300 feet above. The older part is sheltered, the newer part exposed. The wind during one year was from the northwest on 102 days; southwest, 150 days; northeast, 58 days; southeast, 23 days; north, 19 days; south, 5 days; east, 3 days. The atmosphere is warm. Fogs occur rarely. There is moderate shade in the streets. The rock is limestone. The older town is on diluvial soil—very rich. East and northeast winds troublesome to consumptives. The people are chiefly Americans; there are a few Irish, Jews, and negroes. Consumption is comparatively rare, mostly hereditary. The Americans are more liable to it, and of these, stone-cutters. The disease is generally acute, sometimes chronic, usually hereditary. The reporter, Dr. Traill Green, has no evidence in favor of contagiousness. Rheumatism is prevalent; malaria, pneumonia, and Bright's disease are not. Death-rate to 1,000, 16+. All causes.

No. 2. South Bethlehem; population, 5,000; elevation, 400 feet. Sheltered. North and west winds prevail. The atmosphere is generally cool and dry. Fogs occur occasionally. The rain-fall is stated to be

about forty-four inches. There is sandstone overlying limestone. The drainage is by cess-pool. The soil is good. Easterly winds are most troublesome to consumptives. No great liability to sudden changes. The people are largely occupied in factories. Consumption is not marked. A certain portion of the town, on made ground near a brook acting as an open sewer, is thought to be associated with phthisis; but that can not be said of individual houses. The disease is usually acute. In one very marked case the patient was cured by going to southern Colorado. Malaria is not especially prevalent; rheumatism is; pneumonia and Bright's disease are not.

Schuylkill County.—Six replies. Five say that consumption is rare; one says it is not very prevalent. They usually speak of the liability of miners to the disease.

No. 1. Pottsville; populaiton, 12,000; elevation, 614 feet. The town is sheltered by surrounding hills. The wind is usually southwest in clear weather. The air is cool and dry. There are no fogs. The country is hilly and dry, and woods are nearly destroyed. The soil is of medium or poor quality. East winds are troublesome to consumptives. The town is liable to sudden changes of temperature, and there is a decided difference between the temperature at noon and at night. The chief occupation is coal-mining. All nationalities are represented. Phthisis is hereditary in nine tenths of the cases. Rheumatism is prevalent; malaria, pneumonia, and Bright's disease are not.

No. 2. Mahanoy City; population, 10,000; elevation, 1,343 feet. The town is sheltered between two mountains, but is cold. At Mahanoy Plane the mean annual temperature for 1885 was 50·58°. The rain-fall was 52·24 inches. Fogs occur occasionally. The soil is poor. Easterly winds are troublesome to consumptives. The town is especially liable to sudden changes of temperature. The people are largely miners of all nations. The disease is chronic, and can not be averted except by change of climate. Malaria and Bright's disease are not prevalent; rheumatism and pneumonia are.

No. 3. St. Clair; population, 4,000; elevation, 752 feet. The town is exposed and cold. Northwest winds prevail. The air is cool and dry; no fogs. No woods. The country is hilly, and the soil gravelly; good drainage. Mixed population. Phthisis is usually acute. The reporter does not believe it to be contagious. Rheumatism, pneumonia, and Bright's disease are prevalent; malaria is not. (See Dr. Carr's report of hereditary cases.)

No. 4. Tremont; population, 3,000; elevation, 762 feet. The town is sheltered. North and west winds prevail. The air is cool and dry, and there are few fogs. Woods scarce. The country is hilly, and the soil gravelly of poor quality. North and northwest winds disturb consumptives the most. Changes of temperature at times marked; usually a heavy fall at night. Americans are the more liable to phthisis, the disease usually taking a chronic course. The reporter, Dr. J. W. Bird, cites

two cases in which wives nursed consumptive husbands, and soon fell sick and died of the disease; also one case in which the husband, who had to nurse his wife, is now (March, 1886) sick, unable to work, and will eventually die of tuberculosis.

Malaria, rheumatism, pneumonia, and Bright's disease are not prevalent.

No. 5. Schuylkill Haven; population, 3,300; elevation, 625 feet. The town is sheltered in part by mountains. Northwest and southeast winds prevail. Mean annual rain-fall, 1880 to 1885, 38·85 inches. Woods scarce. The soil is clay and red shale; of medium quality. People employed in factories and shops. The people are of German and Irish origin. Phthisis is usually chronic. Rheumatism is prevalent: pneumonia and Bright's disease are not. Malaria prevailed for five years, owing to dredging a canal and dumping mud within the town. The intermittent character has given place to the remittent.

"Our town is on the left bank of the Schuylkill River, the greater part of it four miles below Pottsville. It lies in a valley running east and west, broken by hills, mountains bounding it north and south, about three miles apart. Soil principally red shale and clay; natural drainage good.

"Surface drainage of town good, but many cellars have water during wet months. The upper part is built on hill and inclined plane; the lower part is very level; simply enough inclination for surface water to run off by little artificial aid. Cellars often filled with water; sanitary condition of town otherwise very good. Malaria was unknown here till five or six years ago, when it appeared suddenly to a great extent. Schuylkill Canal runs through the town. For many years past the canal was annually dredged, and deposit thrown within town limits. About a year ago malaria disappeared almost as suddenly as it came, the fevers changing to a remittent type instead of intermittent, and less under the control and power of the cinchona alkaloids. During the last year new and extensive excavations have been made by the Pennsylvania Railroad extension, which did not renew malaria. The lower part of town was the main locality affected during the five years. It had the fogs and prevailing winds somewhat modified by the consecutive mountain boundary south and east. Had scarcely any typhoid fever during the reign of malaria. No severe epidemics of any form in the five years since I have been here. Had diphtheria last spring in some families; many cases assumed the croupous form. If there is any disease prevailing more than other common diseases, it is naso-pharyngeal catarrh.

"Respectfully, C. Leuker."

No. 6. Pine Grove; population, 1,200; elevation, 520 feet. The town is exposed to north winds. Southwest winds prevail. The air is said to be damp and foggy. The amount of rain is put at 42 inches, and there is a great deal of snow. The town is shady and cool in summer. The country is hilly, and the rock is slate. The soil is of medium quality. East winds are troublesome to consumptive patients. Sudden changes of

temperature are frequent. Phthisis, in what few cases there are, takes a chronic course; it is always hereditary. Malaria and Bright's disease are not prevalent; pneumonia and rheumatism are.

Snyder County.—Two replies. Shamokin Dam; population, 300; elevation, 800 feet. The town is exposed and cold. The prevalent winds are north and west. The atmosphere is cool and damp; fogs occur. There is a great deal of snow; not much shade. There are sewers in the town. There are neighboring ponds and marshes. The soil is a sandy clay. The town is especially liable to sudden changes of temperature; there is a marked fall at night. The people are engaged in farming and lumbering; these are of American descent for several generations, and there are Germans. Consumption is very prevalent. In some families all die of it before the fortieth year. Three such families have but one representative remaining; the latter is forty years of age, and is dying of consumption. The offspring die between the twentieth and thirtieth year. The intermarriages prove that it is hereditary. A few of the family left years ago for Colorado, where they are stout and hearty.

The low and swampy areas and individual houses are associated with phthisis. These houses are damp. Consumption is prevalent among Americans, is usually acute, and is promoted by hereditary influences.

Malaria is prevalent, and consumption is especially prevalent in malarial districts. Rheumatism and pneumonia are also prevalent; Bright's disease is not.

No. 2. Freeburg; population, 700; elevation, 509 feet. Sheltered. North and west winds prevail. The air is cool and dry, at times warm; fogs at times. Shade in streets. Trees have been cut down around some houses. Ponds, marshes, hills, and valleys. North winds troublesome to consumptives. People engaged in farming; of American descent and Germans. Not much consumption. Phthisis hereditary; infectious. Little malaria. Rheumatism, pneumonia, and Bright's disease not prevalent.

Susquehanna County.—Three replies. No. 1. Susquehanna; population, 4,000; elevation, 914 feet. The town is sheltered. North, south, and west winds prevail. The place is cold in winter and warm in summer. Few fogs. There is not much shade in the streets. The natural drainage is good. There is a loam of medium quality, with gravelly subsoil. The town is built on side-hills. Southerly winds are the most troublesome to consumptives. There are sudden changes of temperature. The people are employed in factories and machine shops; about half are Americans, three eighths Irish, and one eighth Germans. Consumption can be said to be neither prevalent nor rare, and in nearly all cases is chronic, and in one half the cases hereditary. No evidence of contagion. There is only a slight amount of malaria, and no prevalence of rheumatism, pneumonia, or Bright's disease.

No. 2. Great Bend; population, 1,509; elevation, 884 feet. The town is cold. North and south winds prevail. The atmosphere is cool

and damp. There is a medium amount of rain and snow. There is much shade from woods about the town, and there are hills and valleys. The soil is of medium quality. South winds are troublesome to consumptives. The town is liable to sudden atmospheric changes. The people are employed in farming and lumbering; they are Americans, Germans, and Irish. There is a moderate amount of consumption, which assumes both an acute and a chronic form, and in three fourths of the cases is hereditary. Malaria, rheumatism, and pneumonia are prevalent; Bright's disease is not.

No. 3. Montrose; elevation, 1,053 feet. The town is exposed. West winds prevail. The air is cool and dry, and fogs are rare. There is a great deal of snow. There is not much shade from woods. The country is hilly, and the soil good. East winds are most troublesome to consumptive patients. Atmospheric changes marked. The people are engaged in farming and in factories. The people are chiefly of American descent. Phthisis is prevalent, particularly so among negroes. Neither pneumonia, malaria, nor Bright's disease prevails. Rheumatism is prevalent.

Venango County.—Six replies. Two from Oil City; population, 9,500; elevation, 1,008 feet on the flats; but the town is built on its seven hills. It is exposed and cold. Northwest winds prevail. The air is cool, and fogs are occasional. There is a great deal of snow, and not much shade. There are many hills and valleys. The soil is very poor. North and northwest winds are troublesome to consumptives. There are sudden atmospheric changes, amounting at times to 40° in six hours or less. The people are attracted by the oil-wells from all sides. This reporter, Dr. McCulloch, says phthisis is rare, generally acute, and largely hereditary, perhaps altogether so. From an experience of thirty-eight years' practice, the doctor believes phthisis to be infectious. Malaria and Bright's disease are not prevalent; pneumonia and rheumatism are.

The second reply from Oil City says consumption is prevalent, and describes the place as sheltered by hills. Phthisis hereditary in 72 per cent. of cases. In other respects the two accounts harmonize. The reporter, Dr. F. F. Davis, adds that the winds are very variable, sometimes blowing from different directions two or three times in a day; in summer from the southwest, and in winter from the northwest. When an east wind has been blowing, or one from the south, and there is a sudden change to the north and a sudden fall of temperature, consumptives suffer. Americans suffer most; Jews never. A majority of the cases are hereditary. Consumption is as common in the hilly portion of the city as in the lower and more wet portion. (See Dr. Davis's letter.)

Three replies from Franklin; population, 6,000; elevation, 954 feet. The place is sheltered. Westerly winds prevail. The air is damp, changeable, and fogs occur. The mean rain-fall (1875 to 1880), 40·9 inches. There is a medium amount of snow. Not much shade. There are hills and valleys. The soil is a sandy loam, with gravel, and is of medium

quality. Southwest and northwest winds are most troublesome to consumptives. There are decided atmospheric changes. The people are attracted by the oil wells, and are of all nationalities. All agree that consumption is rare. No especial house or race is associated with phthisis. Hereditary influence is noted as in nearly 100 per cent. of cases, and the disease is chronic. Some patients have been benefited by a sojourn in South Carolina, Florida, Colorado, and California. The total death-rate from all causes is 11·7 in 1,000.

Dr. Stephen Bredin writes:

"In a practice of twenty-five years I have known several families afflicted with infectious consumption.

"The W. family. A son, aged about thirty-five, a worker in walnut-wood rails and stairing, returned home after a hæmorrhage, and in the last stage of consumption. After his death, his sister in attendance took the disease, as did also two other members of the family, aged, respectively, about twenty-six, twenty-eight, and thirty. None of the large family non-resident took the disease. The house was well lighted, well warmed, not shaded. Circumstances above the average. The father robust, the mother spare in flesh, and nervous in temperament. The surroundings were a rich alluvial, well-cultivated soil, with a rather low, ill-drained meadow of forty acres or so in front. No consumption in or about the neighborhood until the arrival of the sick son.

"McK. family. Father stout, but afflicted with a fistula in ano all his life. Mother large, raw-boned, healthy, but spare, a constant weaver by occupation all her life. House an old, badly kept frame, fronting south on a low alluvial but well-drained meadow. No shade, badly lighted, ventilated, and warmed. Two sons, robust men, engaged in the business of oil well drilling, and thus much exposed, returned home and died of consumption. Three sisters and one brother, all adults and apparently well, carried off by consumption in succession.

"D. family. Father stout. Mother thin but healthy. House new frame, well lighted and ventilated, poorly warmed. Close on the north and west side large, tall white-oak timber; soil stiff clay, rich alluvium. Son afflicted with chronic diarrhœa, malarial probably; after recovery, declined and died of consumption in six months. Two sisters taken, and both died of a rapid consumption on the same day. Another taken afterward. By my advice, family removed into another county; no more deaths; has returned and occupied the same farm for a period of years with no more deaths. House better warmed, and timber entirely cut away.

"R. family. Husband had cough and extreme pallor; family history bad, having lost three or more relatives with consumption. Wife's family history good; spare in habit, with nervous temperament. Under my treatment for a long time for palpitation and hypertrophy of the heart, having been afflicted previous to marriage. Mother of five children; youngest, one year old; developed, after weaning this child, a quick con-

sumption. Autopsy revealed extensively diseased lungs. The husband survived her one year, dying in New Mexico of consumption."

No. 5. Emlenton; population, 1,100; elevation, 850 feet. The town is sheltered; west winds prevail; the air is damp and fogs occur frequently. There are woods about the town, but not much shade in the streets. The country is hilly and the soil is poor. There are sudden changes of temperature. The people are occupied in farming and mining for oil. They are largely of American descent. Consumption is prevalent and chronic; hereditary in one half the cases. Malaria is becoming prevalent; rheumatism and pneumonia prevail; Bright's disease does not.

Dr. J. E. Hall writes that the town is situated in a narrow valley and on a side-hill on the east bank of the Allegheny River, 89 miles above Pittsburgh. The town is sheltered from west winds by a hill covered with hemlock on the west bank of the river. Acute phthisis is rarely seen. The doctor thinks that the gas from the oil-wells is injurious to persons in whom consumption is well marked, but is perhaps beneficial in the early stages; also in bronchitis. However, the gas is not considered an especially valuable therapeutic agent.

Group III.

Blair County.—One reply. Hollidaysburg; population, 5,000; elevation, 953 feet. Sheltered. West winds prevail. The air is cool and dry. Fogs are infrequent. There is a medium amount of snow. There is shade in the streets. Soil good. Northeast winds troublesome to consumptives. The people are engaged in factories and in mining, and of various nationalities. Phthisis not prevalent, but is more frequent among Americans and negroes; hereditary and chronic malaria not prevalent nor associated with phthisis. Rheumatism and pneumonia prevail in winter and spring. Bright's disease not prevalent.

The town is situated on a hill-side. Rock, limestone. There are several sewers. No ponds or marshes. Meadows are dry. The town is surrounded, at a distance of one to ten miles, by an "amphitheatre of mountains."

Clearfield County.—Four replies. Two from Clearfield; population, 3,000; elevation, 1,103 feet. The town is exposed and cold, though sheltered on east and west. Fogs occur frequently in the autumn. The site of the town is nearly level, having been at one time a swamp. The streets are shaded, so as to make the air rather cool and damp. The soil is of medium quality. There is an alluvial deposit ten to fifteen feet deep. At the bottom is a substratum of gravel; rock below and sand above. East winds are very troublesome to consumptives. There are sudden changes of temperature. The difference between noon and night is often very marked. The mid-winter temperature is steadily low. The people are engaged in agriculture and lumbering; they are of American descent chiefly. There are some Irish and Germans. Consumption pronounced by one observer to be rare and chronic, and by the other to be

prevalent and acute. Both acknowledge heredity. The cases are largely among Americans, except in stone-cutters' consumption, where race does not protect. Dr. Hartswick believes that consumption is infectious, having met with a number of instances where the husband, wife, sister, or nurse has apparently contracted the disease after long and constant watching at the bedside. No malaria; rheumatism, pneumonia, and Bright's disease prevail.

No. 3. Houtzdale; population, 2,500; elevation, 1,800 feet. The town is exposed and cold, situated on a hill-side. North and west winds prevail. The air is cool and dry; there are occasional fogs. There is not much shade. The soil is a loam and clay, of medium quality. North and east winds are troublesome to consumptives. There are great changes of temperature. The people are engaged in mining and in lumbering. They are Americans, German, and Irish. Phthisis is said to be comparatively frequent, and is both acute and chronic. Patients have been cured by going South. Dr. Todd furnishes the following history of a case of tuberculosis of left lung: "In 1880 I went to southern Texas and gained twenty-five pounds in weight. One year since, after an attack of typhoid fever and pneumonia, I weighed but one hundred and forty-five pounds, a loss of fifty pounds. I now weigh two hundred pounds, and am free from cough, night-sweats, and other indications of phthisis. Relief due, I am confident, to change of climate, use of cod-liver oil with hypophosphites, and whisky. Last winter I spent several weeks in St. Augustine, Fla." The majority of cases are hereditary. There is some malaria, but it does not appear to have any relation to consumption. Rheumatism and pneumonia prevail. Bright's disease does not, although there are some cases.

No. 4. Curwensville; population, 1,300; elevation, 1,141 feet. The town is very much sheltered by hills. The prevailing winds are northwest and east. Atmosphere cool, often damp; not much fog. There are woods near the town and abundant shade in the streets. The soil is poor, sandy, gravelly, and slaty; there is a clay subsoil. Drainage excellent. There are no ponds, bogs, or meadows. Very little marsh land. Hills. East winds trouble consumptives. Changes of from 40° to 50° occur in twenty-four hours, and a marked fall at night. The people are of American descent, engaged in farming and in lumbering. There are some coal-mines and a few factories. Consumption is said to be very prevalent and hereditary. A family is instanced, living ten miles from Curwensville, dwelling near the river in a very sheltered spot, where the sun shines but a few hours each day. The atmosphere is very damp and foggy. Four or five members of the family have died there, and more are likely to die, of phthisis. The disease is as frequently acute as chronic. There is little success in preventing consumption. No malaria. Very little Bright's disease; some pneumonia; more rheumatism.

Clinton County.—No reply.

Indiana County.—One reply. Indiana; population, 3,000; eleva-

tion, 1,300 feet. The town is exposed, on elevated ground. There are low hills on the west, north, and east. Temperature averages in July, 78°. In January, 32°. West winds prevail. Atmosphere changeable; dry. No fogs. Snow seldom lies long on ground. Not much shade. Soil, loam and slate, with clay. Rock, micaceous sandstone. Few ponds or marshes. East winds most troublesome. Sometimes severe changes in temperature. Farming is the chief occupation. Some lumbering and mining. Population mixed. "Consumption is becoming prevalent"; it is acute and chronic. Some cases have been cured by moving to the West and Northwest. Hereditary in nine tenths of the cases. The reporter, Dr. W. Anderson, is satisfied that consumption is contagious or infectious. No malaria. Rheumatism prevalent. Pneumonia prevalent in winter and spring. Bright's disease occasional.

Luzerne County.—Two replies. No. 1. Wilkesbarre; population, 35,000; elevation, 480 feet. The city is in a long valley sheltered by mountains rising 1,200 feet above the valley. The city is hot in summer, cold and variable in winter. The winds are westerly and southwesterly. The air is often damp and foggy. The rain-fall averages 42 inches. Heavy snow-storms. There is shade from woods outside the town and in the streets. The soil is medium, alluvial, covering the carboniferous shales, slate, and clay. There are sewers. Few marshes or ponds. Hills. North and northeast winds are troublesome to consumptives. There are sudden atmospheric changes. The nights in hot weather are cool, even chilly. The occupation of the people is chiefly mining for coal. Phthisis is not very prevalent. There are individual houses where the disease has been frequent, but there has also been an hereditary influence. Such houses have usually had damp cellars or have been in the vicinity of standing water. In an extensive practice, Dr. Mayer has never seen an instance where nurse, husband or wife, mother or sister, contracted the disease during or shortly after its occurrence, progress, or ending. Malaria is prevalent. Dr. Mayer thinks that the congestions of malarial disease are probably frequent factors in developing phthisis in those who inherit a tendency to it, and he has frequently seen this occur. He has no evidence that malarial troubles are antagonistic to pulmonary consumption. Bright's disease is prevalent; so also is rheumatism. Cyclic albuminuria due to malaria is frequently observed.

Dr. Mayer adds:

"Nationality: About 40 per cent. American descent; 30, Irish and Welsh, with some English; 20, Germans; 2, negroes; 4, Jews; and 4, Poles and Huns.

"Consumption very rare among the Jews. Have only known of three deaths from it in twenty-five years among that race, and two of these were in the same family. It is very common among negro hybrids, particularly quadroons or octaroons. It is also most common among the native-born children of Irish and Welsh parents, who work in the mines or chutes, and in those of several generations of American descent; among

young women working in dry-goods stores, and those in factories handling cotton and woolen goods.

"I have known of at least ten cases of incipient phthisis apparently cured by going from this district. A minority, say one third of these, by going to Florida, Texas, southern Georgia, etc.; two thirds by the change to the climate of Minnesota or that of the region about Denver. I never knew of a patient benefited by coming here from another locality.

"In spite of the repeated urgings of our doctors, our stupid town authorities have never given us a board of health, and in most of our cemeteries a doctor's certificate is not required before burial. I can find in the offices of the different cemeteries here no reliable records of the causes of death."

No. 2. Kingston; population, 1,600; elevation, 600 feet. The town is exposed. Westerly winds prevail in winter. Fogs occur. The soil is alluvial and very rich. Mining is the chief occupation, and all nationalties are represented. Phthisis is rare among the native Americans; common among the Irish miners. Hereditary influence is recognized, and miners suffer; the disease is both acute and chronic. Patients have been cured by going to California. The reporter, Dr. Corss, thinks the disease is infectious. Malaria is prevalent, but seems to have nothing to do with phthisis.

Dr. Corss says:

"The dust from anthracite coal is fine and impalpable, hanging in a black cloud over every breaker. It induces a form of consumption in which asthma is a prominent symptom. The miners who cut the rock tunnels suffer from a disease known among them as rock-miners' consumption; of this the prominent symptom is a shortness of breath, not generally asthmatic, but more like miliary tuberculosis. Rock-mining is considered more dangerous than coal-mining."

Lycoming County.—One reply. Williamsport; population, 2,800; elevation, 700 feet. Sheltered. West and northwest winds prevail. The air is cool; there are no fogs. There is not much shade outside the town, but in the streets, and trees have been cut down for health. The soil is alluvial clay. There are meadows, marshes, and hills. The soil is rich on the low ground, poorer on the hills. East and northeast winds are troublesome to consumptives. There are marked atmospheric changes. The people are engaged in factories and in lumbering. Five per cent. are of German birth, 2 per cent. Irish, 1 per cent. Jews, 7 per cent. negroes. Consumption is prevalent. The reporter, Dr. Hill, has known whole families to die of consumption, but they have not all lived in one house. Hereditary tendency has extended to the third generation, though a majority of cases furnish no history of ancestral phthisis. Americans and negroes are particularly liable, and one half the cases terminate in six months. Dr. Hill believes patients may be cured by removal to high tablelands and pine forests; also, in contagion. There is a good deal of chronic malaria. Phthisis is not prevalent in malarial districts. Rheumatism,

pneumonia, and particularly disturbances of all mucous membranes, are prevalent. Bright's disease does not prevail.

Northumberland County.—No reply.

Perry County.—Two replies. No. 1. Newport; population, 2,500; elevation, 400 feet. The town is sheltered and warm. West winds prevail. Fogs occur. Not much shade. There are neighboring meadows, marshes, and hills. The soil is of medium quality and alluvial. East winds are troublesome to consumptives. Sudden changes of temperature are not frequent. People engaged in factories and in trade, and are of American descent. There is a moderate amount of phthisis, chiefly chronic and hereditary. Malaria is not especially prevalent, but seems to be an exciting cause of phthisis in those predisposed to it. Rheumatism, pneumonia, and Bright's disease are not prevalent.

No. 2. Landisburg; population, 400; elevation, 740 feet. Exposed. West winds prevail; air cool; fogs occur. Not much shade. Hills and valleys; poor soil. Southerly winds troublesome to consumptives. Liability to sudden atmospheric changes. People engaged in farming, and of American descent. Phthisis rather rare; usually acute. Rheumatism prevalent; pneumonia to a moderate extent. Bright's disease not prevalent.

Somerset County.—No reply.

Tioga County.—Five replies. All pronounce consumption rare. The report from Arnot, a town of 4,600 inhabitants and at an elevation of 1,700 feet, says: "No resident ever had it here." In Arnot north and south winds prevail. The atmosphere is dry; fogs do not occur. There is a medium amount of snow; not much shade. There are ponds and meadows, hills and valleys. The chief occupations are coal-mining and lumbering. The people are of American descent, Germans, Irish, Poles, and Hungarians. There is some malaria; pneumonia and Bright's disease are not prevalent, but rheumatism is frequent from reckless exposure. The reporter, Dr. D. C. Matins, writes: "I have known many persons apparently in a decline cured entirely by inhaling the dust of these mines with the smoke from lard-oil lamps and burning powder, and drinking the water impregnated with sulphates." The doctor speaks of the frequency of miners' asthma and, from an experience of over two hundred autopsies, of the occurrence of "healed cavities."

No. 2. Wellsboro; population, 3,500; elevation, 1,300 feet. The town is sheltered. West and northwest winds prevail. Air cool; fogs rare. Streets shaded. Soil good. Sudden atmospheric changes. People of American descent and Germans. Phthisis chronic and more prevalent among negroes; usually hereditary. Rheumatism is prevalent; no malaria or Bright's disease; some pneumonia.

No. 3. Blossburg; population, 2,800; elevation, 1,348 feet. Sheltered. North and south winds prevail; air cool; no fogs. Surrounding hills wooded. The soil is a clayey loam of medium quality. No great atmospheric changes. Phthisis hereditary. Two houses (the best in town) have

had several cases of phthisis; three wives and two daughters of Americans in two years past have been under reporter's care. The disease is chronic and hereditary. Malaria not prevalent. Rheumatism and pneumonia are not uncommon.

No. 4. Osceola; population, 800; elevation, 768 feet. Sheltered by hills on the north and south. West and east winds prevail. Rain and snow medium; little woods. There are meadows and valleys. The soil is very rich. South and east winds trouble consumptives. No great changes of temperature. The people are engaged in farming and are of American descent. Phthisis is chronic and in 80 per cent. is hereditary. The reporter, Dr. Humphrey, thinks he has evidence in support of infection. Malaria and Bright's disease are not prevalent. Rheumatism and pneumonia are.

No. 5. Cherry Flats; population (village), 110; sheltered. West winds prevail. Air is cool and dry. Not much shade. Meadows, hills, and valleys. Soil good; red shale. South winds troublesome to consumptives. There are sudden changes of temperature. Chief occupations are farming and lumbering. People of American descent and Welsh. Phthisis chronic; hereditary in two thirds of cases. Infectious in rare cases. Little malaria. Rheumatism and pneumonia are prevalent. Bright's disease is not.

Dr. H. G. Martin reports a patient with incipient phthisis cured by going to Colorado, where he has lived twenty years. On three occasions he has returned home, but at these times cough recurs. In thirty years' practice, and twenty-five of that an extensive practice, "I have treated but ten or eleven cases; one of them was of twenty years' standing when I first saw the case, and the patient lived nineteen years. One other case ran for fifteen years. I have a case at present of four years' standing, and the patient may die of old age. She is Irish; the rest have all been Americans."

Warren County.—Two replies. Irwin; population, 2,000; elevation, 800 feet. The town is exposed and cold. Northwest winds prevail. The air is cool and dry. Small amount of snow. There is not much shade outside the town, but some in the streets. There is a liability to sudden atmospheric changes. The people are largely foreign of every nationality. Phthisis is only moderately prevalent. In two houses there have been six cases; all hereditary; one case acute. It is prevalent among Americans and is mostly chronic. The reporter, Dr. Humphrey, does not believe that the disease can be prevented in children hereditarily predisposed. He says he has known cats become tubercular from eating sputum. Malaria is not prevalent; pneumonia moderately so. Bright's disease rare. Rheumatism prevalent.

No. 2. Sheffield; population, 1,500; elevation, 1,100 feet. Sheltered and warm. West winds prevail. Air cool and damp; fogs occur. Medium amount of snow and rain. There are ponds and marshes, hills and valleys. Soil good. North winds troublesome to consumptives. The people

are engaged in factories and in lumbering. They are of American descent, German, Irish, and Swedes. Consumption is prevalent; Americans chiefly affected; usually chronic; three fourths of cases hereditary. Some malaria. Rheumatism, pneumonia, and Bright's disease are prevalent.

Wayne County.—One reply. Honesdale; population, 7,000 (1880); elevation, 1,000 feet. In the county it ranges from 714 to 2,040 feet. Surface very irregular. There are hills and valleys; lakes and ponds numbering 76. Town exposed northwest and south; sheltered east and west. Northwest winds prevail. Air cool and dry; at times damp. Fogs occur. Average rain-fall for last five years, 38 inches. Average snow-fall, 73 inches. In 1857–'58, snow-fall, 27 inches; in 1867–'68, 115 inches. Storms come with northeast, east, and southeast winds. Trees about the town; have cut trees in streets. Soil good to medium; red shale. Liability to sudden atmospheric changes; sometimes a fall of fifty degrees between noon and night. People engaged in farming and lumbering, of American descent, German, and Irish. Phthisis rare in town, prevalent in country. Individual houses damp, associated with phthisis. The disease is acute; hereditary influence marked. Malaria prevalent in town, and consumption especially so in malarial districts. Rheumatism, pneumonia, and Bright's disease are prevalent in the county, but not in town.

Westmoreland County.—Three replies. No. 1. Ligonier; population, 700; elevation, 1,250 feet. Average general mortality, 18 in 1,000; from consumption, for thirteen years, one in 16·48 of total mortality.

Loughlinstown; population, 192. One death from phthisis in 4·03 of total mortality.

Stonerville; population, 400; elevation, 750 feet. The town is sheltered, located in a flat. The air is cool and dry. Fogs seldom occur. The soil is clay over limestone. There are hills, valleys, and meadows; no sewers, ponds, bays, or marshes. The soil is very rich. East or southeast winds are troublesome to consumptives. There are sudden atmospheric changes, and there is a moderate fall of temperature at night. The people are farmers and miners, and are American, German, and Irish. Consumption is rare; hereditary in 80 per cent. and chronic. Americans of Irish and German descent have suffered the most. Miners are particularly affected.

Dr. Rigg, in the case of a lady patient, when there was little or no improvement in Stonerville, sent her to New Mexico, to a warm location, 2,500 feet high. After staying one year, she came back seemingly cured. At the end of six months the old trouble returned. She was then sent to Somerset County, Pa., to an altitude of nearly 2,500 feet. She has been there eighteen months, and seems to be perfectly well.

Pneumonia and Bright's disease are prevalent. No prevalence of rheumatism.

No. 3. West Newton; population, 2,500; elevation, 782 feet. Town sheltered. South, east, and west winds prevail. Air dry; fogs do not

occur often. Not much shade. Hills and valleys. Soil medium and good. Northern winds troublesome to consumptives. There is a liability to changes of temperature. The people are engaged in factories and in mining. They are of American descent, German, and Irish. Consumption is rare and of chronic form and hereditary. The reporter, Dr. Robinson, thinks he has evidence in favor of infection. Malaria and Bright's disease not prevalent. Rheumatism and pneumonia moderately so.

York County.—Six replies. One says consumption is rare, and four say that it is prevalent. Dr. J. C. Gable and Dr. A. A. Long, of York, report: population, 20,000; elevation, 450 feet. Sheltered. West winds prevail. Air damp and variable. Fogs occur. Streets well shaded, but no trees. Soil very rich. South and east winds troublesome to consumptives. Liability to changes of temperature. The people are engaged in farming and in factories; they are Americans, chiefly of German descent. Dr. Gable states that the damp portions of the town are associated with phthisis. All houses more or less damp. Americans and negroes liable to phthisis; the latter is generally chronic, and in three fourths of cases hereditary. Malaria is prevalent, and consumption is prevalent in malarial localities. Rheumatism, pneumonia, and Bright's disease are more or less prevalent.

Dr. Gable relates the case of Mr. W. H. K., who died of phthisis after an illness of two years and a half. His wife, of healthy stock, was his constant attendant, and lived in the same room with him. Before his death she showed prodromes of phthisis, and died one year after the husband.

No. 3. Hanover; population, 3,000; elevation, 600 feet. West winds prevail. Air cool and dry. Fogs rare. Rain-fall has been thirty-eight inches. Not much shade. Meadows and valleys. Good soil; limestone. East winds troublesome to consumptives. No liability to sudden atmospheric changes. People engaged in farming and in cigar factories; of American descent. Phthisis frequent in American "well-to-do" families. The disease is chronic, and nearly always hereditary. Reporter does not believe in infection. Malaria and rheumatism not prevalent. Pneumonia prevails, and Bright's disease is increasing.

No. 4. Wrightsville; population, 2,000; elevation, 300 feet. Exposed to both heat and cold. Northwest winds prevail. Atmosphere generally cool; fogs frequent. Little shade. Limestone. Hills north and south. Ponds and marshes north. River east; creek south. Soil very rich. Liability to great atmospheric changes. People engaged in cigar factories, quarries, lime-kilns, saw-mills, etc. American-born outnumber negroes, Irish, and Germans. Houses near water more closely identified with phthisis. The proximity to water believed to induce consumption. The houses associated with phthisis are damp and cold. Phthisis more frequent among the poor; it is acute and chronic, and generally hereditary. The reporter, Dr. Rebman, thinks he has seen children hereditarily predisposed saved from phthisis by protection from cold and wet, etc. Consumption

is more prevalent in miasmatic districts. Rheumatism and pneumonia prevalent; Bright's disease especially so.

No. 5. Dillsburg; population, 500; elevation, 1,065 feet. Sheltered. North and west winds prevail. Shade in the streets. No liability to sudden atmospheric changes. People engaged in farming and mining; of American descent. Consumption rare. There is a central portion of the town having damp cellars and yards where consumption is frequent. These localities not influenced by heredity. Phthisis chronic; not at all hereditary. The reporter believes that consumption can be prevented from occurring in children hereditarily predisposed by removal from family influences, and "plenty of good whisky." He also believes that phthisis is infectious. No malaria. Rheumatism, pneumonia, and Bright's disease not prevalent.

No. 6. Hallam. In a limestone valley, ranging from one to two miles wide, extending west from the Susquehanna. A range of low hills of slate and limestone and flint, north and south, near Wrightsville. Springs and running streams numerous. Through the valley and on the north side of the valley consumption is seldom seen; but on the south side it is frequent. Reporter can not explain why.

In summer, the air is warm and often damp and foggy; in winter, cold and dry. Timber covers about one sixth of area. Consumption frequent, chronic, and hereditary. There is a good deal of malaria; no relation to consumption. Rheumatism and Bright's disease are not frequent. Pneumonia is prevalent.

Group IV.

Clarion County.—One reply. No. 1. Clarion; elevation, 1,947 feet. The town is exposed. In spring and fall there is foggy and wet weather. Liability to sudden atmospheric changes. West winds prevail. Rainfall, forty-two inches in 1885. Not much shade. There are meadows, marshes, hills, and valleys. Soil medium. West and northwest winds troublesome to consumptives. The people are engaged in farming, mining, and lumbering. The people are Americans, Germans, Irish, and Jews. Consumption moderately prevalent; increasing each year; occurs in Americans and negroes; usually chronic. Patients have been cured by removal to San Antonio, Texas. No true malaria. Pneumonia occurs in spring and autumn. Bright's disease not prevalent.

Elk County.—Two replies. No. 1. Ridgway; population, 2,000; elevation, 1,437 feet. Town sheltered, but cold. West and northwest winds prevail. The air is cool and damp. Fogs occur. There is shade from woods about the town. There are meadows, hills, and valleys. Soil of medium quality. West and northwest winds troublesome to consumptives. There is a liability to sudden changes of temperature; great fall of temperature at night in warm weather. People engaged in lumbering; of American descent, German and Irish and Swedes. Consumption of "medium" frequency. Nearly all the pulmonary disease has been in

the vicinity of a tannery on the north side of the town, near the Elk Creek, inhabited chiefly by Swedes. Disease chronic; apparently hereditary in twenty per cent. of cases. No prevalence of malaria: no relation of this to consumption. Rheumatism and pneumonia prevalent. A few cases of Bright's disease.

No. 2. Dagus Mines; population (within radius of one mile), 3,000; elevation, 2,000 feet. The town is sheltered and cold. West and north winds prevail. Air cool, damp. Occasional fogs. Not much shade. Meadows, marshes, hills, and valleys. One marsh northwest of town a mile and a half long, a quarter to a half mile wide. Snow in winter two to four feet deep on level, and lasts five to six months. In 1884–'85 lasted six months less three days. Temperature in winter usually from + 10° to — 20° F. In summer it reaches 95°, but usually about 75°. Sudden changes. Soil poor. People chiefly of foreign birth; few Americans. Consumption very rare; acute and chronic. Malaria or Bright's disease not prevalent. Rheumatism, pneumonia, and bronchitis frequent.

McKean County.—One reply. Smethport; population, 1,500; elevation, 1,500 feet. The town is in a valley. Northeast and southwest winds prevail. The air is variable. There are fogs. Medium amount of snow and rain. There are ponds and meadows. The soil is of medium quality. Northeast winds are troublesome to consumptives. There are sudden changes of temperature. People engaged in farming, lumbering, and in factories; American and Irish. Consumption is rare, chronic, and always traceable to syphilis; it is amenable to specific treatment. Malaria not prevalent, and not associated with phthisis. Rheumatism prevails among the low Irish. Pneumonia is moderately prevalent. Bright's disease is occasional.

TABLE I.—*120 Replies to a Circular sent by Dr. Pepper to physicians in Pennsylvania. To accompany an Address on the Distribution of Phthisis.*

Group and Number of Reply	County	Town	Population	Elevation	Location	Prevailing winds	Atmosphere	Fogs	Annual Rain-fall	Snow	Woods outside town	Much shade in town	Trees cut for health
Group I													
1	Berks	Mohnsville	500		Sheltered	W.	Cool and damp	Fogs	Medium	Great	Yes	Yes	Yes
2	"	Reading	43,278	280	Shelt. & warm	N. W.	Warm and dry	"		"	No	No	No
3	Bucks	Falls Township	....	19	Sheltered	N. W., S. W.	Cool and dry	"	42 in.	30 to 40 in.	No	Yes	No
4	"	New Britain	150		"	W.		"	Medium	Medium	No	Yes	No
5	"	Point Pleasant	300		"			"	"	"	Yes	Yes	No
6	Chester	Blue Rock		557	Exposed	Cold	Cool, dry	"				No	
7	"	West Chester	8,000	461	Sheltered	N. W.	Cool, dry	"	48 to 50 in.	Small	No	Yes	Yes
8	"	Unionville		350	Sheltered, warm and cold	N. W.	Variable	None	Medium	Medium	No	Yes	No
9	"	West Chester	8,000	451	Exposed	N. W.	Dry	Slightly	48 in.	Small	No	Yes	
10	"	"	8,000	461	"	"	Cool and dry		48 in.	Medium	Yes	Yes	Yes
11	Erie	Erie	36,000 (?)	573	"	W.	Cool, damp	Yes	42 in.				
12	Franklin	Greencastle	1,600		Sheltered	W.	Cool, dry	Fogs	Small	Large	Small	Yes	Yes
13	"	Upton	165	665	Exposed, cold	W., S. E. & E.	Cold and damp		Medium	"	No	No	No
14	"	Chambersburg	10,000	605	Sheltered	N. W.	Moist	Not foggy	42.5 in.	"	"	Yes	No
15	"	St. Thomas	500	800		N. and W.	Dry		Medium			Yes	No
16	Mifflin	Milroy	2,000	600	Exposed	N. W.	Cool, damp	Very seldom	"	"	None	Yes	No
17	"	Newton Hamilton			Shelt'd & cold	S. W.	"	Fogs			Yes	Yes	No
18	"	McVeytown	700	532	Exposed	W.	"	"			No	No	No
19	"	Lewistown	4,000	801	"	W.		"	Medium	Medium		Moderate	No
20	Philadelphia	Conshohocken	5,000	210	"	W. and N.	Cool, dry		40.44 in.		No	No	No
21	Washington	Monongahela City	3,000	750	Sheltered	E., W.	Damp			Large		Yes	Necessary
Group II													
22	Adams	York Sul. Springs	400	800	"	W.	Warm, dry	Medium					Yes
23	"	Gettysburg	2,700	442	"	W.	Dry, cool	Seldom	35 in.	Medium	Some	Some	Yes
24	"	Bonneauville	148			W.	"	Fogs	Medium	"	Yes	Moderate	No
25	"	McKnightstown	100	600	Exposed	W.	Cool, damp	Sometimes	Great	Great	No	No	No
26	"	Little Town	1,000	600	"	W.	Warm	Occasionally	Medium	Medium	No	No	No
27	"	Gettysburg	2,700	442	"	W.	Cool, dry	Seldom	31 in.	"	Yes	Yes	No
28	Allegheny	Pittsburgh	185,000	766	Sheltered				37 in.		No		
29	Armstrong	Worthington	150	1,100	"	N. and W.	Cool, damp		Medium	Medium	No	No	No
30	"	Kittanning		809	"			Seldom	40 in.	"	Medium	Medium	No
31	Beaver	Beaver Falls	8,000	600	"	W.	Damp	Yes	Medium	"	No	No	No
32	Bedford	Bedford	3,000	1,200	Shelt'd & cold	W.		Fogs occur	Great	Great	No	Yes	No
33	Bradford	Terry Township	8,000	900	Good	S. W., N. W.		"	Medium	Medium	No	No	No
34	"	Athens	3,000	750	Sheltered	S. and N.	Warm, cold	Fogs	Light	Light	Yes	Yes	No
35	"	Troy	1,500	1,118	"	N., S. W.	Cool, dry	Very seldom	Medium	Medium			A little
36	Cambria	Johnstown	25,000	1,200	"	W.		Decar.		Great	Yes	Yes	No
37	"	"	25,000	1,200	"	N. W.	" damp		"	Medium			
38	Carbon	Weatherly	3,000	1,200	Shelt'd & cold	E., W.		Not often	"	Great	No	No	No
39	Centre	Bellefonte	3,200	753	Sheltered, cold	N. W., S. W.	Damp, cool	At times	"	Medium	No	Yes	No
40	"	Philipsburg	5,000	1,500	Sheltered, warm	S. W., W.	Dry, cool	None			No		
41	"	Zion	100	835	Exposed, cold	S. W.		Seldom					No
42	Columbia	Catawissa	2,100	477	Sheltered	N. W.	Damp, cool	Fogs	36.7 in.	50 in.	Yes	Yes	Yes
43	Crawford	Titusville	8,000	1,191	Sheltered, warm		Damp	Some	Medium	Medium	Yes	Yes	Yes
44	"	"	8,000	1,191	"	W.	"	"	Great	"		Yes	No
45	Cumberland	Shippensburg	3,000	660	Exposed	W.	"	"	Medium	"		Yes	Yes
46	"	Newville	1,800	520	"	N. W., E.	Dry, cool	None				Yes	No
47	Delaware	Clifton	600		Sheltered, warm			Seldom				Yes	No
48	"	Clifton Heights		151	"	W.						Yes	No
49	"	Upland	2,500	100	" warm	W.	Moist	Frequently			Yes	Yes	No
50	Fayette	Uniontown	5,000	950	Exposed, cold	S. E., N. W.	Cool, damp	Seldom	Great	Small			No
51	"	Brownsville	1,200	774	Sheltered	W.	Variable	Yes	36.07 in.				No
52	"	Vanderbilt	1,000	1,200	" warm	Variable		"	Medium	Medium	No		No
53	"	New Haven	1,000	920			Dry	Yes	"	"	No	No	No
54	"	Dunbar		995		N., W.	Cool, dry	No	Small	Small	Yes	Yes	No
55	Huntingdon	Birmingham	1,100	750	Exposed, cold	W., S. W.	Damp, cool	Yes	"	"	No	No	No
56	Lackawanna	Scranton	70,000	750	"	"	Variable	Yes					
57	"	"	70,000	750	"	N., E., W.		Yes			No	Yes	No
58	Lancaster	Ephrata	1,500	381									
59	"	Bird in Hand	350	359	Cool	W.	Cool, damp	Yes	Small				No
60	"	Bainbridge	850	271	Exposed	W.	Warm, dry				Yes		
61	"	"	850	271	"	W.	Dry	No	Small	Small	No	Yes	No
62	"	"	850	271	"	E.						Yes	No
63	"	Manheim	2,000	402	Sheltered, warm		Variable	Yes		"	No	Yes	No
64	"	Paradise		355	Exposed	E., W.	Dry	Yes		"	No	Yes	No
65	Lebanon	Lebanon		466	Sheltered	S., E.	Cool, dry	Not often		"	Yes	Yes	Necessary
66	Mercer	Sharpsville	1,810	918	" warm	S. W.	Damp				No	No	No
67	"	Sharon	7,000	1,150	"	S., E.	Warm, dry	Seldom	Small		Yes	Yes	No
68	Montgomery	Marlon Square	500	400	Exposed	S. W.	Cool, dry	None	Medium		Yes	Yes	No
69	"	Bryn Mawr			" cold	S., N. W.	"				No	No	No
70	"	Perkiomen	2,545			W.	"	Yes			No	No	No
71	Northampton	Easton	11,924	190-300	Sheltered	S. W., N. W.	Warm	Yes	Great		No	Yes	No
72	"	So. Bethlehem	5,000	400	"	W.	Cool, dry	Yes					
73	Schuylkill	Pottsville	12,000	611	"	W.	"	No	Medium		No	Yes	No
74	"	Mahanoy City	10,000	1,312	"	E., E. & W.	Cool	Yes		Great	No		
75	"	St. Clair	4,000	752	Exposed, cold	N. W.	" dry	Yes		"	No		
76	"	Tremont	3,000	762	Sheltered	N., W.	"	Few	Great	No			
77	"	Schuylkill Haven	3,300	625	"	W., S. W.	Cool	Yes	See tables	Medium	No		
78	"	Pine Grove	1,200	520	Exposed	S. W.	Damp	Yes	Medium	Great	Yes		
79	Snyder	Shamokin Dam	500	800	" cold	S. W.	Cool, damp	Yes					
80	"	Freeburg	700		Sheltered	W.	" warm	Yes					
81	Susquehanna	Susquehanna	4,000	1,000	"	N., S. & W.	Cool, warm, dry	Yes	Medium	Great			
82	"	Great Bend	1,500		Cold	N., E.	Cool, damp	Yes			No	No	
83	"	Montrose		1,653	Exposed	W.	" dry	Rare			No	No	Yes
84	Venango	Oil City	9,500	1,008	" cold	W.	Cool	Yes					
85	"	Franklin	6,000	954	Sheltered	W.	Damp	Yes	Medium	Medium	No		
86	"	"	6,000	954	"	W.	Cool, damp	Yes					
87	"	Emlenton	1,100	850	"	W.	Damp	Yes			Yes	No	
88	"	Oil City	9,500	1,008	"	S. W., N. W.	Cool, damp	Yes	Great		No	No	No
89	"	Franklin	6,000	954	"	W.	Changeable	Frequent	40.9 in.		No	No	No
Group III													
90	Blair	Hollidaysburg	5,000	1,000	"	W.	Cool, dry	Infrequent	30-40 in.	Medium		Yes	No
91	Clearfield	Clearfield	3,000	1,103	Exposed, cold	W.	Cool	Yes	30-40 in.				Yes
92	"	Houtzdale	2,500	1,800	"	N. W.	" dry	Occasionally	30-40 in.	Great	No		
93	"	Curwensville	1,300	1,141	Sheltered	N. W., E.	" damp	Seldom			Yes	No	No
94	Indiana	Indiana	3,000	1,300	Exposed	W.	Dry	None		Great	No	No	
95	Luzerne	Wilkes-Barre	35,000	550		W.	Cold, variable	Yes		Great	No	No	No
96	"	Kingston	1,000	600	Exposed, cold and warm	W.		Yes	40 in.	Small			
97	Lycoming	Williamsport	28,000	700	Sheltered	W., N. W.	Cool	No	Medium	Medium	No	Yes	Yes
98	Perry	Newport	2,500	393	"	W.		Yes			No	No	
99	"	Landisburg	400	740	Exposed	W.	Cool	Yes			No	No	No
100	Tioga	Arnot	1,000	1,700	Sheltered, warm	N. W.	Cool, dry, cool	Fogs rarely	Medium	Medium	No	No	No
101	"	Wellsboro	3,000	1,300	"	W., N. W.	Cool				Yes		
102	"	Osceola	800			W., E.	"	Fogs		"	No	Yes	Yes
103	"	Blossburg	2,500	1,250		N., S.	" dry	No		"	No	No	
104	"	Cherry Flats	150								No		
105	Warren	Sheffield	1,000	1,300		N. W.	"	Fogs			No	No	
106	"	Irvine	1,000	800	Exposed, cold	N. W.	"	Yes		Small	No	Moderate	No
107	Wayne	Honesdale	3,000	980	Expos'd & shel.	N. W.	" dry, damp	Fogs	37.07 in.	73.3 in.	Yes	Yes	No
108	Westmoreland	West Newton	2,500		Sheltered	W.	Dry	Not often	Medium	Medium	No	No	No
109	"	Ligonier	750	1,250	Sheltered, cold			Yes					
110	"	Stonerville	5,000	750	"	S. W., N. W.	Cool, dry	Seldom	Medium	Medium	No	No	No
111	York	Hellam				W., S.		Foggy			No	No	No
112	"	Dillsburg	300	1,045	Sheltered	W., S.		No	Medium		Yes	No	No
113	"	Wrightsville	2,000	300	"	N. W.		No		52 in.	No	No	Yes
114	"	York	20,000	450	Sheltered	W.		Fogs	38 in.		No	No	No
115	"	Hanover	3,000	600	Exposed	W.	" dry		38 in.	Small	No	Yes	No
116	"	York	20,000	300-400	Sheltered	W.	Medium, damp	No	38 in.	Medium	Yes	Yes	No
Group IV													
117	Clarion	Clarion		1,947	Exposed, cold	W.	Cool, damp	Fogs	42 in.	Medium	No	No	No
118	Elk	Ridgway Mines		2,000	Sheltered, cold	N. W.			Great	Great	No	No	No
119	"	Ridgway	2,000	1,417	"	N., W.				Medium	No	No	No
120	McKean	Smethport	1,500	1,500	"	N. E., S. W.	Variable	"	Medium		No	No	No

Group and Number of Reply	Geological structure	Sewers, ponds, bays, meadows, marshes, hills, valleys	Soil	Wind troublesome to consumptives	Liable to sudden atmospheric changes	Marked fall of temperature at night	Occupation	Nationality	Phthisis prevalent or rare	Any part of town liable to prevalence of phthisis
1		Meadows, hills, valleys, ponds	Medium		Yes	Yes	Farming & factories	Amer. and Ger.	Rare	No
2		Hills, valleys, ponds	Good		No	No	Factories	All	Prevalent	No
3	Clay, gravel	Meadows	Medium		No	No	Farming	American	Rare	No
4		Hills and valleys	Very rich	N. E.	No	No	"	"	Prevalent	No
5		" " "	Medium	E.	Medium	Common	"	All	"	No
6	Clay	Marshes	Good	E.	Yes		"	American	Rare	No
7	Rock		Rich	E.	No	Yes	"	Am. & negroes	"	No
8		Ponds, meadows, hills, valleys	Medium good	E.	Yes	Yes	"	"	"	No
9	Rock, clay	Swamp, sewers	Good		Not liable, but diff'nce at night		"		Prevalent	No
10	Rock	Sewers	Rich	E.	Not specially	No	"	Am. & negroes	Rare	No
11					Yes	Yes	Manufacturing	Mixed	Prevalent	
12	Limestone	Ponds	Rich	S. and E.	Sudden	Yes	"	American	Rare	No
13	Slate, limest.	Hills, bays, marshes	Rich & mel.	W.	Changeable		Agricult., mechanics	"	"	No
14	Limestone	None	Good	N. and N. W.	No	No	Facts., farm'g, mdse.	"	Moderate	No
15		Hills and valleys	Medium	N.	No		Farming	"	Prevalent	No
16	Limestone	Sewers, hills, valleys	Good	E. and N. E.	Yes		Everything	All	Rare	No
17		Sewers	Medium		Yes		Farming	American	Prevalent	No
18	Alluvial			N. E.	Yes	In summer only	Farming and mining	All	Rare	No
19	Limestone					Yes	Working in iron	American		No
20			Good	N. W.	No	No	Rolling-mills	All	Rare	No
21	Clay, alluvium	"		E.	Yes	No	Farming, mfg., min.	"	Moderate	No
22		Hills and valleys	"	N. and E.			Farming	Ger. and Scotch	Medium	No
23		" " "	Good red shale	S. and N. E.		Quite marked	Farm'g, mdse., mfg.	American	Rare	No
24		Rolling land	Good	N. and E.	Yes, sp'g & fall		Farming & laboring	Ger., Scotch, Ir.	"	No
25	Red clay	Meadows, hills, and valleys	"	N. & N. W.	Yes		Farming	Amer. & Germ.	"	No
26		Undulating	Medium	E.			"	American	Rare	No
27	Red shale	Hills and valleys	"	S.	Yes	Yes				No
28	Carboniferous		Medium				Factories	Mixed	Prevalent	No
29		Meadows, hills and valleys	Sand	All winds	Yes		Mining	American	Rare	No
30		Valley	Good	S.			Mfg., merchandise	Amer., Ger., Ir.	Moderate	No
31	Gravel	"	Medium	S. E.	Yes	Yes	Factories	Mixed	Prevalent	No
32		Sewers	Poor & v'y rich	E. and S.	Yes	Yes	Factories, lumbering	All	"	No
33			Good	S. E.		Yes	Farming, lumbering	American	Rare	No
34	Stone, gravel		Rich	S. W.	Yes	Yes	Factories, farming	Irish & German	"	Yes
35	Clay		Good	S.		20-30°	F., L.	Amer., Ger., Ir.	"	No
36		Hills, valleys	Medium		Yes	Yes	Steel and iron mills	All	"	No
37					Yes	Yes	Factories, mining	Amer., German	"	No
38					Yes	Yes	Manufacturing	Amer., Ger., Ir.	"	No
39	Limestone	Hills, no marshes	Good	N. W., N. E., S. W.	Yes	Yes	Farming & factories	Mixed	Moderate	No
40		Hills	"	N., N. E.		Yes	F., mines, L.	Mixed	Rare	No
41	Limestone	" ponds	Very rich	S.		Yes	F., mines, L.	Amer., Ger., Ir.	"	No
42			"	E.	Yes		F., lumbering, R. R.	Amer., Ger., Ir.		No
43	Slate, sandst.	Ponds, marshes	Good	N. E.	Yes	Yes	Oil, mines, mdse.	Amer., Ger., Ir.		No
44	Clay, loam	Sewers		S. W.	Yes	Yes	Many	Mixed	Not infrequent	No
45	Limestone	Meadows, hills	Very rich	E. to N.	Yes	Yes	F., fact., mining, L.	Amer., negroes	Prevalent	No
46	Limest., slate	Hills, valleys	Rich	N.	Yes	No	F.	Scotch, Irish	"	No
47	Clay loam	Sewers, meadows	Good				F.	Amer., Ir., Ger.		No
48		Hills	"		Yes			"		No
49	Clay	Surface drainage	"	N. and E.	Yes	Yes	F., manufacturing	American, Irish	Somewhat prev.	No
50	Limestone	Hills, valleys	"	N. W.	Yes	Yes	F., mining	Mixed	Prevalent	No
51	Limest., clay	No marshes	Rich	E.	No	Yes	F., " factories	Native Amer.	Rather preval'nt	No
52		Hills and valleys	Good	N. E.	Yes	Yes	F., "	Mixed	Frequent	No
53			Rich	S. E.	Yes	Yes	Mining, manufact'g		Prevalent	No
54		Hills, valleys	Medium	E.	Yes	Yes	" L.		Moderately prev.	No
55		Ponds, hills, valleys	"	W.	Yes	Yes, 20-30°	F., mining	American	Some	No
56		Hills, valleys	"		Yes	Yes	"	Mixed	Prevalent	No
57		Sewers	"		Yes	Yes	"	"		No
58		Springs	Rich		Yes		F.	German	Some	
59	Limestone		Good	E.	Yes		F.	Amer., German	Prevalent	No
60	Sandy loam		Rich		Yes			" "	Very rare	
61	Limestone	Hills, valleys	"	E.	No			" "	Rather rare	No
62			Good	E.		No		" "	Frequent	No
63		" valleys, ponds, etc.	"	E.	Yes	Yes	F., factories	" "	Not frequent	No
64	Limestone	Valley	Rich	S. E.	No		F.	" "	Rare	No
65			Very rich	E.	Yes		Factories	" "	Prevalent	No
66	Sandst., alluvial	Hills	Good	S.	No		Manufacturing	Amer., Ger., Ir.	Moderate	No
67		" valleys	"	N.	Yes			Ir., Ger., A. Jews	Rare	No
68			"	S.	Yes		F., factories	Amer. & Irish	"	Yes
69	Slate mica		Medium	E.	Yes		F., etc.	Amer. & Irish	"	No
70	Red shale		Good	E.	Yes		F., etc.	Am., Ger., Ir.	Moderate	No
71		Sewers, hills, alluvial	Rich	E. by N. E.	Yes		F., mfg., mining	Am., Ger., E.	Rare	No
72	Sandstone	Valleys	Good	E.		No	Factories	Amer., German		Yes
73		Hills	Medium	E.	Yes	Decided	Mining	Mixed	Very rare	No
74		Valley	Poor	E.	Yes	Yes	"		Rare	No
75	Gravel	Hills, valleys	Medium	E.	Yes	Yes	"			No
76			Poor	N., N. W.	Yes	Yes		Am., Ger., E., I.		No
77	Red shale clay		Medium		Yes	Yes	Manufacturing	Am., Ger., Ir.	Moderate	No
78	Slate	Hills, valleys		E.	Yes	Yes	Mining	American	Rare	No
79	Sandy clay	Meadows	Very rich	S. E.	Yes	Yes	Farm'g & lumbering	Am. and Ger.	Very	Yes
80			Rich		Yes	Yes	Farming		"	
81		Hills and valleys	Medium	S.	Yes	Yes	Fact. & mach. shops	Am., Ir., Ger.	Rare	No
82			"	S.	Yes	Yes	Farming, lumbering	Am. and Ger.	Moderate	No
83		Hills and valleys	Good	E.	Yes	Yes	F. and factories	"	Rare	No
84		" " "	Poor	N. and N. W.	Yes	Yes	Dealers in oil	All or mixed		No
85	Sandy loam, with gravel	" " "	Medium	N. W.	Yes	Yes	Manufacturing	Mixed		No
86		" " "			Yes	Yes	Oil mining	Chiefly Amer.	Rare	No
87		Hills	Med. & poor		Yes	Yes	Farming and mining	American	Prevalent	No
88		Partly sewered; no marshes	Good & med.	N. & N. W.	Yes	Yes	Railroads, manufact.	All	"	No
89	Hills & rocky		Medium	N. W.	Yes	Yes	Manufacturing	Mixed	Rare	No
90			Good	N. E.			Mining, factories	"		No
91	Sand, gravel		Medium	E.	Yes	Yes	Factories, lumbering	"	Rare	No
92	Loam clay			N. and E.	Yes	Yes	Mining, lumbering	"	"	No
93	Sandy, clay	Hills	Poor	E.	Yes	Yes	Farming, lumbering	"		No
94	Clay slate		Good	E.	Yes	Yes	"	Mixed	Prevalent	No
95	Alluvial	Hills and valleys	Medium	N. & N. E.	Yes	Yes	" "		Rare	No
96	River drift		Very rich	S. W.			Mining & factories	All	"	No
97	Clay	Meadows, marshes	Rich	E., N. E.	Yes	Yes	Factories, lumbering		Prevalent	No
98		Meadows, marshes, and hills	Medium	E.	Yes	Yes	Factories	American	"	No
99		Hills and valleys		S.	Yes	Yes	Farming		Rare	No
100		All meadows, hills & valleys	Poor	S.	Yes	Yes	Mining & lumbering	All	No	No
101	Clay		Good		Yes	Yes	Varied		Rare	No
102		Meadows and valleys	Rich	S. and E.	Yes	Yes	Farming	American	"	No
103		Hills and valleys	Medium		Yes	Yes	Mining & lumbering	All	"	No
104			Good	S.	Yes	Yes	Farming, lumbering	Am. and Welsh	"	No
105				S.	Yes	Yes	Factories, lumbering	All	Prevalent	No
106		Meadows, hills, valleys		S.	Yes	Yes	Farming, mining, etc.	"		No
107			Medium	N. W.	Yes	Yes	Farming, lumbering	"		No
108			Good and bad	N.	Yes	Yes	Factories, mining	Am. and Ger.	Rare	No
109		Hills, valleys	Good		Yes		F.			No
110	Clay, limest.	Hills, no marshes	Very rich	E., S. E.	Yes	Moderate	F., mining	Am., Ger., Ir.	"	No
111		Hills, valleys	Med. & poor	E., S. W.	No	Yes	Farming	American	Prevalent	No
112		Meadows, hills, valleys	Good	E.	No	Yes	Farming & mining		Rare	Central
113		" " " ponds	Very rich	Neither	Yes	Yes	Everything	All	Yes	Yes
114		" " "	Good	E.	Yes	Yes	Farming, factories	"	Prevalent	Yes
115		" " "		E.	No	Yes	"	American		No
116		Valleys and meadows	Very rich	S.	Yes	Yes	"	Am. and Ger.		No
117		Hills, marshes, vall'ys, m'dows	Medium	W., N. W.	Yes	Yes	Farm., min., lumber	Ger., Ir., Jews		No
118		" " " "	Good and poor		Yes	Yes	Mining, lumbering	All	Very rare	No
119		" " " "	Medium	W., N. W.	Yes	Yes	Lumbering	"	Medium	No
120		Ponds, meadows, hills, valleys	"	N. E.	Yes		F., mfg., lumb'ng	Am., Irish	Rare	Yes

Group and Number of Reply	Peculiarities of spot or district	Phthisis frequent in special houses—their character. Heredity	Phthisis frequent in any race or occupation	Phthisis acute or chronic	Cases cured by removal to or from this locality	Phthisis hereditary. Per cent	Phthisis prevented in children hereditarily predisposed	Evidence for infectiousness or contagiousness of phthisis	Malaria prevalent	Relation of malaria to phthisis	Rheumatism prevalent	Pneumonia prevalent	Bright's disease prevalent	Name of physician reporting
1				Chronic	Coming to	Hereditary			No	No	No	No	No	M. B. Shaner
2		No	Cot.-fact. employees	"	No	Majority	Yes	No	Yes	No	No	No	No	W. F. Muhlenberg
3		Yes	No	"	No	Yes, 75%		Yes		No	Yes	No	No	J. A. Richards
4		No	Americans	"	No	No	Yes	Yes	Yes	No	Prevalent	Prevalent	No	Harvey Kalz
5		No	No	Acute	No	Hereditary	No	Yes	Very rare		No	No	No	A. M. Cooper
6		No		Ac. & chr.		H., 25%	Yes		None		No	None	No	F. W. Frankhauser
7	No	No	Negroes	Chronic	No	Yes, 25%	Yes	Yes	None		No	No	No	Thos. D. Dunn
8		None	None		None	75%	Yes	None	No		Yes	No	Yes	W. R. Purdue
9		No	Negroes	"	No	Hereditary		Yes						
10		Not mark'd	Mixed	"	Going west	"	Yes	Yes	No	No	Not spec.	Not spec.	Not spec.	Jacob Price
11									Yes					F. W. Gerner
12		None	No	Chronic	No	Yes	Yes	None	No		Prevalent	Prevalent	No	J. C. Gilbert
13		Yes	No	Both	No	H., 25%	Yes		No		Yes	Yes	No	Wm. P. Noble
14	No	Yes	Mulattoes, negroes	"	Going west	H., 75%	Yes		Yes	Causative	Rare	Not comm.	No	Geo. S. Hall
15		No		Chronic	No	Yes			No		No	No		
16		No	No	Acute	No	Don't know	Yes		No					A. Hershberger
17	Yes	Yes	No		No	No			Very prev.		No	No		C. P. Mahon
18	No			Chronic	Going west	Hereditary	Yes		Yes	No	Yes	Yes		A. Rothrock
19							Yes		Slightly		None	None	Slightly	A. H. Shaffer
20		No	Irish and factory	Both	No		No	Don't know	A little	Yes	Yes	Yes	Yes	G. M. Stiles
21		No	No	Chronic	Going from	Nearly all H.	Yes	Yes	No	No	Yes	Yes	No	P. B. Wood
22						H. very much	Yes	No			No	Yes	Yes	J. W. Pearson
23		No	Negroes	Acute	No	Small %	Yes		None		Some	Some	Very rare	
24		Heredity	Americans & Ger.	Chronic	No	90%	Yes	Yes	Yes		Yes	Yes	No	H. Noel
25		Yes	No	Acute	No	Yes, 60%	Yes	Yes	Yes	Yes	Yes	Yes	No	R. B. Elderdice
26		No		"		No			Yes		No		No	R. S. Seiss
27		Yes	Americans	Chronic	No	Hereditary	Yes		No		No		No	J. W. C. O'Neal
28														W. H. Mercur
29		No		Chronic	No		Yes		No	No	No	Yes	No	John K. Maxwell
30				"		Majority	Yes		No					M. H. Allen
31			Grinders & polish'rs		Going from	Hereditary	Yes				Yes			Theo. P. Simpson
32		Yes	Amer. & negroes	Both		H., 75%	Yes	Yes	Yes		Yes	No		S. H. Gump
33	Malarial			Chronic	No	50%	Yes		Yes		Yes	Yes	No	Geo. F. Heaton
34		Slight	Irish	Both		Hereditary	Yes	Yes	No	No	Yes	Not very	At times	E. P. Allen
35				Chronic	Coming to	Yes, 100%	Yes				Yes	Yes	Yes	C. V. Dare
36				Chronic	No	Not entirely			No		Yes	Yes	No	W. B. Lowman
37			Irish	Chronic		Majority	No		No		Yes	Yes	Yes	J. M. Cooper
38				"		Hereditary					Yes	Yes	Yes	C. H. Latham
39			Axe-grinders	"		H., mostly	Yes		No	None	Yes	Yes	No	G. H. Harris
40				"	Coming to	H., 60%					Yes	Yes	No	Hubert Allport
41		No	Axe-grinders	"		H., 75%	Yes		Yes	No	Yes	Yes	No	
42		No		"	No	H., 75%			No	Yes	Yes	No	No	J. H. Vastine
43		No	Swedes	Acute		H., 50%	Yes		Yes	None	Yes	Yes	No	Geo. H. Mead
44		No	Swedes, Am., Irish	Chronic		Hereditary	Yes		Yes		Slightly	Yes	No	Wm. Varian
45		No	Americans	"	Going from	H., 90%	Yes		Yes		Yes	Yes	Yes	John J. Koser
46		No	Negroes, Indians	"		Hereditary			None		Yes	Yes	No	W. C. Stewart
47			All alike	"			Yes		Rare	None	Yes	Yes	No	A. W. Walcott
48		Yes, H.	Irish manufacturers	Acute, chr.	No	H., 90%	Yes		Yes		Yes	Yes	No	S. P. Burleson
49		No	None	Chronic	Going from	Occasionally	Yes		None	None	Yes	Yes	No	John T. M. Cardeza
50		No	Amer., negroes	"		H., largely			None		Yes	Yes	No	J. H. Ewing
51		No	No	Both	Going from	Hereditary			Yes		Yes	No	Yes	W. S. Duncan
52		No	No	Chronic					No		Yes	Yes	No	J. D. Hazlett
53		No	Amer., negroes	Both	Going from	H., 60%	Yes		None		Yes	Yes	No	
54		Yes, damp, sh'dy	Americans	Acute		H., mostly	Yes		Yes		Yes	Yes	No	R. W. Clark
55		No	Americans, English			H., 50%			No		Yes	Yes	Yes	E. H. James
56		No	Irish-Americans			Hereditary	Yes		No		Yes	Yes	Yes	L. H. Gibbs
57		No		Chronic		Acquired	Yes		No		Yes	Yes	No	
58						Hereditary			None		Yes			D. J. McCaa
59		No	Americans	Acute		H., 50%	Yes		No		Yes	No	No	A. M. Miller
60		No		Chronic		H., 100%	Yes		None	None	Yes	No	No	Geo. T. Wiseman
61		No				H., 80%	Yes		Yes	None	Yes	No	No	
62		No				H., 50%	Yes		None		Yes	No	No	
63		No		Ac. & chr.	Coming to	Hereditary	Yes		Yes	Some, but	Yes	No	No	J. Francis Dunlap
64		No	Miners	Chronic		H., 75%	Yes		Yes	No	Yes	No	No	A. H. Smith
65		Yes; damp	No		Going from	H., 4	Yes		Against	No	Yes	Yes	No	Wm. M. Guilford
66														
67		Yes		Chronic	Going from	Hereditary			Yes	Prevents	No	No	No	E. Griswold
68	Low	Yes				H., 75%	Yes		None		No	No	No	H. A. Arnold
69		Yes			No	H., 30%	Yes		Slightly		Yes	No	No	G. P. Sargent
70		No	All alike			Hereditary	Yes		Yes	Excites	Yes	No	No	Samuel Wolfe
71		No	A. W., Innocent	Acute, chr.			Yes		None		Yes	No	No	Traill Green
72			None		Going from						Yes	No	No	
73	No	No	Miners	Chronic		H., 60%			No		Yes	No	No	John T. Carpenter
74	No	None	No			Acquired	None		No		No	No	No	
75				Acute			Yes		No		Yes	Yes	No	W. P. Carr
76	None	No	Americans	Chronic	None	Hereditary	Yes		Yes	No	Yes	Yes	No	J. W. Hirst
77	None	No		"							Yes			
78	None			"		H., 100%	Yes		Yes		Yes	Yes	No	
79		Yes	Americans	Acute		Hereditary	Yes		Yes		Yes	Yes	No	H. H. Boshner
80									Slightly					H. M. Nipple
81				Chronic	None		Yes		No		No	No	No	Samuel Birdsall
82				Both					No		No	No	No	E. F. Wilmot
83	None	None	Negroes			H., 75	Yes		No		Yes	Yes	No	Calvin C. Halsey & Wm. E. Richards'n
84		No		Acute	None	Hereditary	No		No		Yes	Yes	No	J. C. McCulloch
85		No		Chronic					No		Yes	No	No	E. W. Moore
86		No		Acute		H., 75%	Yes	Yes	Yes	No	No	No	No	Stephen Bredin
87					None	H., 50%	Yes		No			No	No	Jos. E. Hall
88		No	Amer., negroes	Both	Going s'th.	75%	Yes		No		Yes	Yes	Yes	F. F. Davis
89		No	No	Chronic	No	Hereditary	Yes		No	No	Yes	Yes	No	Joseph Bell
90			Amer., negroes			Large per cent	Doubtful		No	No	No			Crawford Irwin
91				Acute			Yes		None		No	Yes	Yes	H. B. Van Valzah
92				Both	Going from	Hereditary	Yes		None	None	Yes	Yes	No	
93														
94				Chronic	Going from	H., 60%	Doubtful		None		Yes	Yes	No	Wm. Anderson
95					Going from	Hereditary	Yes							
96				Both	Going west	Yes	Yes		Yes					Frederick Corss
97		Yes	Amer., negroes	Acute	No	Hereditary	Yes		Yes	No	Yes	Yes	No	G. A. Hall
98				Chronic			Yes		Yes		Yes	Yes	No	James B. Eby
99		No		Acute	No	No			No		Yes	Slightly	No	D. H. Milliken
100		No		No			Yes		Some		Yes	Yes	No	D. C. Mulrens
101		No		Chronic		Hereditary	Yes		Yes		Yes	Yes	No	D. W. Parker (dec'd)
102		No	Rare		No	Yes	Yes		Yes		Yes	Yes	No	Wm. F. Humphrey
103		Heredity	Yes		No	Yes	Yes		No		Yes	Yes	No	W. H. Jennings
104					Going from	Hereditary	Yes		No		Yes	Yes	No	H. G. Martin
105			Americans		No	Yes, 75%	Yes		Yes		Yes	Yes	Yes	J. F. McNutt
106		No			No	Yes	Yes		Yes		Yes	Yes	Rare	G. L. Humphreys
107		Yes	No	Acute	No	Yes	Yes		No	Some inc.	Yes	Yes	No	W. H. Cummings
108				Chronic	No	Hereditary	Yes		No	No	Yes	Yes	No	J. Q. Robinson
109											Moderat'ly	Moderat'ly	Yes	W. D. McGowan
110		Yes, H.	American-Irish	"	Going from	80%	Possibly	None	No	No	No	Yes		J. E. Rigg
111	No	No	Miners	"	No	Hereditary			Yes	No	Yes	Yes	No	J. Deisinger
112	Damp sewers and yards	Yes	Americans	"	No	No	Yes		No		Yes	Yes	No	Wm. D. Bailey
113	Yes	No	All	Both	No	Hereditary	Yes	Yes	Yes	Some inc.	Yes	Yes	Very	G. A. Rebman
114	Yes	No	Laboring classes	Chronic	No	Yes	Yes		Prevalent		Yes	Yes	Prevalent	J. C. Gable
115			All		No	Yes	Yes		No		Yes	Yes	Prevalent	Horace Alleman
116		No	Amer. & negroes		No	H., 75%	Yes		Prevalent		Yes	Yes	Yes	A. A. Long
Group IV														
117		No		Both	Going from		Yes		No	No	Mod'rat'ly	Yes	No	
118				Both			Yes		No	No	Yes	Yes	No	
119		No	Swedes	Chronic	No	Hereditary	Yes		No	No	Yes	Yes	No	J. S. Ward
120	By river side	No	No		No	Syphilitic	Yes		No	No	Yes	Yes	No	S. D. Freeman

TABLE II.

Mortality from Phthisis, Pneumonia, Malarial Fever. General Death-rate and Density of Population in Pennsylvania, by Counties, based on the Census Reports for 1880. Prepared by Guy Hinsdale, M. D.

	Phthisis.	Pneumonia.	Malarial fever.	Occupation.	No. of persons to sq. mile.	Area in square miles.	Population, 1880.	Total death-rate per 1,000.	Persons living to one death from phthisis
Adams	60	26	5	A.	62	530	32,455	15·1	541
Alleghany	563	369	18	M.	469	760	355,869	16·5	632
Armstrong	81	24	..	A.	79	610	47,641	9·7	588
Beaver	64	22	2	M.	88	450	39,605	12·9	618
Bedford	49	29	5	....	35	1,000	34,929	12·3	712
Berks	269	128	11	A.	125	900	112,597	15·4	418
Blair	67	56	3	....	104	510	52,740	11·7	787
Bradford	88	77	8	A.	50	1,160	58,541	13·4	665
Bucks	162	55	6	A.	116	590	68,676	14·2	423
Butler	82	48	2	...	65	820	52,536	11·6	640
Cambria	75	55	..	....	70	670	46,811	15·4	624
Carbon	46	27	2	M.	80	400	31,923	12·5	694
Centre	62	38	1	....	31	1,230	37,912	11·8	611
Chester	189	110	11	A.	110	760	83,481	14·0	441
Clarion	38	26	2	....	71	570	40,328	10·7	1,061
Clearfield	49	44	3	A.	39	1,130	43,308	13·0	883
Clinton	30	22	7	....	30	860	26,178	11·7	872
Columbia	47	46	11	....	67	480	32,409	15·3	689
Crawford	106	53	3	....	68	1,000	68,607	11·3	624
Cumberland	84	58	14	A.	83	550	45,977	13·8	547
Dauphin	110	121	20	...	147	520	76,148	15·6	692
Delaware	109	43	4	....	300	190	56,101	12·2	515
Elk	10	10	..	L.	18	770	12,800	8·0	1,280
Erie	131	88	4	....	71	770	54,688	12·9	417
Fayette	83	49	3	A.	71	830	58,842	13·1	696
Franklin	114	56	8	....	66	760	49,855	16·1	437
Fulton	25	14	..	....	23	440	10,149	13·5	406
Greene	50	16	2	....	46	620	28,273	10·6	565
Huntingdon	57	29	4	....	28	900	33,954	14·1	595
Indiana	47	21	1	....	49	830	40,527	10·4	862
Jefferson	47	14	1	....	44	640	27,935	14·1	594
Juniata	29	32	6	A.	46	400	18,227	14·0	629
Lackawanna	128	93	6	M.	200	440	89,269	10·3	713
Lancaster	240	102	8	A.	144	970	139,447	12·6	581
Lawrence	49	29	4	....	90	370	33,312	9·6	680
Lebanon	66	24	3	A.	110	350	38,476	13·0	583
Lehigh	137	48	4	....	183	360	65,969	14·0	481
Luzerne	150	183	24	A.	145	910	133,065	15·1	887
Lycoming	76	66	5	....	48	1,205	57,486	13·1	756
McKean	32	26	9	L.	42	1,000	42,565	10·8	1,330
Mercer	84	87	12	....	85	660	56,161	11·7	640
Mifflin	54	18	3	...	52	380	19,577	16·0	362
Monroe	27	13	1	A.	33	600	20,175	13·1	747
Montgomery	191	86	8	A.	201	480	96,494	15·0	505
Montour	13	22	12	....	110	140	15,468	12·2	1,189
Northampton	114	84	8	....	185	380	70,312	13·5	616
Northumberland	70	61	18	....	115	460	53,123	14·0	759
Perry	36	24	13	....	58	480	27,522	12·3	764

TABLE II.—*Continued.*

Mortality from Phthisis, Pneumonia, Malarial Fever.

	Phthisis.	Pneumonia.	Malarial fever.	Occupation.	No. of persons to sq. mile.	Area in square miles.	Population, 1880.	Total death-rate per 1,000.	Persons living to one death from phthisis.
Philadelphia	2,677	957	61	T.	6,567	129	847,170	20·4	316
Pike	..	..	..	L.	16	600	9,663	....	...
Potter	12	13	..	L.	13	1,070	13,797	15·0	1,149
Schuylkill	183	126	4	....	155	840	129,974	15·0	710
Somerset	36	12	..	....	30	1,100	33,110	17·4	764
Snyder	30	40	3	....	55	320	17,797	18·6	593
Sullivan	..	..	..	L.	19	430	8,073	....	...
Susquehanna	65	49	3	....	49	830	40,354	13·8	620
Tioga	50	50	2	A.	41	1,120	45,814	12·2	916
Union	16	5	..	....	55	310	16,905	7·6	1,056
Venango	74	37	5	....	66	660	43,670	12·0	590
Warren	31	18	5	....	31	910	27,981	10·6	902
Washington	132	45	2	A.	61	890	55,418	13·8	420
Wayne	35	26	5	....	45	740	33,513	12·8	957
Westmoreland	94	60	3	....	75	1,040	78,036	12·3	830
Wyoming	31	20	1	...	39	400	15,598	14·4	503
York	97	63	7	A.	82	920	87,841	10·7	905
Remainder	15	18	..	....	....	....	22,895	10·0	1,526
Remainder	1	4	..	....	....	....	4,385	7·0	4,385
State	8,069	4,208	207	....	....	45,215	4,282,891	14·9	530
CITIES.									
Pittsburgh	293	197	6	....	....	....	156,389	21·0	533
Alleghany	88	58	7	....	....	....	78,682	11·2	894
Erie	64	47	7	....	....	....	27,730	17·6	433
Scranton	56	42	1	....	....	....	45,850	9·6	818
Reading	111	33	6	....	....	...	43,278	15·8	389

TABLE III.

Mortality from Phthisis in Philadelphia by Wards. 1860–1885.

Prepared by Guy Hinsdale, M. D.

No. of persons to 1 acre, 1880.	122	101	149	128	79	48	110	70	49	101	96	119	112	145	71	100	128	70	61	92	4	3	1	8	4	70	3	9	45	85	68	10	
Area in square miles.	·551	·442	·191	·229	·321	·321	·439	·435	·400	·359	·210	·193	·259	·237	1·05	·281	·251	·650	·742	·731	7·13	18·1	42·7	9·72	13·6	7·18	11·7	6·35	1·4	·519	·713	129	
Census, 1860	30,886	29,123	19,929	23,461	24,792	14,882	31,267	27,770	17,196	21,849	16,681	16,681	20,045	24,258	32,091	20,067	23,264	20,441	38,828	29,963	17,159	17,173	23,985	23,738	....	....	Includes almshouse.	....	....	....	....	....	565,529
One death in every	*324*	*288*	*390*	*225*	*349*	*513*	*252*	*356*	*378*	*420*	*439*	*407*	*371*	*411*	*386*	*417*	*261*	*365*	*310*	*356*	*612*	*520*	*631*	*339*							*371*		
Census, 1870	25,817	30,220	19,149	20,852	18,736	12,064	31,558	22,286	16,629	23,312	14,845	15,771	19,906	22,643	44,650	19,256	21,347	26,366	45,240	56,612	18,861	22,695	20,888	24,932	18,639	36,693	13,385	10,377	See 26th w.	....	....	....	674,022
One death in every	*305*	*262*	*308*	*198*	*217*	*502*	*269*	*305*	*291*	*315*	*345*	*328*	*376*	*404*	*337*	*291*	*236*	*271*	*337*	*343*	*631*	*411*	*455*	*351*	*465*	*312*	*365*	*546*			*292*		
Census, 1880	43,985	28,498	18,271	18,853	16,368	10,004	31,087	19,545	12,481	23,363	12,930	14,690	18,646	22,364	47,865	17,802	20,451	29,354	43,887	43,207	19,699	31,798	26,522	46,057	36,104	35,138	23,284	34,442	10,787	29,100	31,308	....	846,980
One death in every	*274*	*274*	*253*	*248*	*197*	*254*	*223*	*300*	*290*	*440*	*461*	*459*	*396*	*406*	*332*	*323*	*217*	*222*	*315*	*357*	*579*	*496*	*402*	*407*	*469*	*362*	*264*	*492*	*283*	*281*	*377*	*314*	
Highest elevation in feet	24	28	31	34	31	37	42	43	43	41	34	36	43	72	106	34	32	27	99	89	130	440	210	292	133	38	111	255	113	40	37		

YEAR.	Males.	Females.	Under 5 years.	5 to 10 years.	10 to 15 years.	15 to 20 years.	20 to 30 years.	30 to 40 years.	40 to 50 years.	50 to 60 years.	60 to 70 years.	70 to 80 years.	80 to 90 years.	90 to 100 years.	Total.	Almshouse.	Colored.	United States.	Foreign.	Unknown.	LOWER DELAWARE RIVER FRONT. 1st Ward.	2d Ward.	3d Ward.	4th Ward.	5th Ward.	6th Ward.	SCHUYLKILL FRONT. 7th Ward.	8th Ward.	9th Ward.	10th Ward.	11th Ward.—Delaware Front.	12th Ward.	13th Ward.	14th Ward.	15th Ward.—Schuylkill Front.	16th Ward.—Delaware Front.	17th Ward.	18th Ward.—Delaware Front.	19th Ward.—Kensington.	20th Ward.	21st Ward.—Manayunk.	22d Ward.—Germantown.	23d Ward.—Frankford, etc.	24th Ward.—West Philadelphia.	25th Ward.—Bridesburg, etc.	26th Ward.—Schuylkill Front.	27th Ward.—West Philadelphia.	28th Ward.—Falls of Schuylkill.	29th Ward.	30th Ward.—Schuylkill Front.	31st Ward.—Delaware Front.	CITY
1860	786	837	53	20	31	109	538	365	238	143	89	28	7	1	1,523	...	....	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1861	910	907	125	26	24	242	475	423	277	169	115	41	12	..	1,817	154	139	1,008	613	196	95	101	51	104	71	29	121	78	46	52	38	41	54	59	83	48	89	56	125	84	28	33	38	221	38	..	..	..	..	..	..	..	..
1862	961	988	108	32	26	127	608	445	269	172	103	51	8	..	1,949	124	149	1,127	630	192	125	108	55	92	77	41	118	66	45	95	41	46	76	117	54	72	69	126	101	27	38	33	19	14	23	..	..	..	..	..	..	..	..
1863	966	989	70	20	23	128	585	489	307	172	108	47	6	..	1,955	110	161	1,119	689	147	124	124	69	86	72	43	123	78	47	49	38	41	71	87	125	49	78	51	95	92	38	36	52	198	23	..	..	..	..	..	..	..	..
1864	1,087	1,002	117	21	25	143	612	513	335	170	106	39	8	..	2,089	113	212	1,240	699	150	120	95	69	93	92	67	130	70	53	79	37	40	47	76	145	51	86	55	107	109	30	66	11	238	25	..	..	..	..	..	..	..	..
1865	1,020	1,006	111	21	18	164	613	463	279	194	123	44	6	..	2,026	133	186	1,241	639	146	68	109	65	109	57	36	131	73	51	62	42	51	53	66	108	42	71	62	110	104	39	61	51	235	31	69	..	..	..	..	..	..	..
1866	994	950	73	24	19	143	585	474	286	189	108	47	5	1	1,944	131	172	1,119	672	153	48	98	68	83	76	48	129	83	61	53	46	42	43	55	101	55	69	64	102	119	37	46	44	210	28	65	....	..	..	..	..	..	..
1867	942	1,005	72	19	33	153	593	451	297	170	114	35	10	..	1,947	101	160	1,148	681	118	63	113	65	81	85	34	139	80	57	57	37	45	48	74	102	59	63	55	87	133	23	45	53	60	28	73	127	..	..	..	..	..	..	..
1868	1,000	995	79	19	34	142	583	515	308	167	96	45	7	..	1,995	99	133	1,202	665	128	83	105	50	84	66	33	137	47	75	58	32	42	46	60	115	49	75	87	123	130	27	33	10	64	37	93	131	9	..	..	..	..	..	..
1869	982	993	77	16	26	151	628	475	289	163	103	39	6	2	1,975	...	..	1,214	674	87	61	100	66	92	76	30	119	63	54	51	39	47	50	56	110	48	77	72	134	130	20	43	11	63	35	99	102	10	..	..	..	..	..	..
1870	1,118	1,190	84	18	31	170	681	548	366	231	116	55	7	1	2,308	125	153	1,406	732	170	73	115	62	105	86	24	117	73	57	74	43	48	53	56	132	66	90	97	131	165	27	55	48	71	40	117	178	19	..	..	..	..	..	..
1871	1,099	1,138	61	14	29	156	720	573	326	201	103	47	9	..	2,237	95	154	1,381	732	124	73	101	71	78	59	38	141	52	70	59	44	46	46	51	147	42	75	70	181	184	23	51	54	66	39	110	162	14	..	..	..	..	..	..
1872	1,167	1,163	81	13	40	175	733	547	355	190	126	54	11	2	2,330	114	171	1,450	734	146	98	133	67	77	69	46	143	71	44	39	33	33	36	71	136	43	57	88	179	130	31	49	50	66	53	121	188	19	49	..	..	..	..	..
1873	1,093	1,199	70	12	28	187	715	547	329	217	128	49	10	..	2,292	131	187	1,392	729	171	83	100	73	90	64	29	105	68	36	59	34	42	42	51	127	44	77	106	187	109	25	59	56	95	47	132	190	22	76	..	..	..	..	..
1874	1,133	1,171	63	31	17	133	699	547	355	218	123	59	8	1	2,304	97	154	1,412	759	133	85	80	60	85	52	31	127	70	46	47	43	43	40	74	145	29	82	91	224	140	34	55	68	85	55	134	151	28	73	..	..	..	..	..
1875	1,185	1,174	51	17	22	189	722	578	377	219	133	46	1	1	2,359	119	168	1,496	715	148	99	97	72	83	63	39	125	91	44	76	49	38	46	48	114	43	89	79	201	119	27	51	49	96	51	162	166	36	100	..	..	..	..	..
1876	1,289	1,388	64	16	25	217	786	688	415	239	136	52	8	1	2,677	175	219	1,657	818	202	100	100	57	109	67	33	141	77	46	31	51	40	45	74	157	56	85	93	159	131	10	68	10	149	82	122	215	42	97	66	74	..	..	..
1877	1,142	1,207	50	17	32	180	754	585	364	203	111	46	5	2	2,319	135	183	1,508	689	152	120	112	56	84	58	33	130	59	24	55	34	29	50	59	120	59	74	115	130	97	25	60	18	88	74	76	204	42	86	66	76	..	..	..
1878	1,151	1,337	54	15	28	211	735	647	361	236	142	56	5	1	2,491	95	201	1,604	766	121	106	112	57	77	57	27	118	73	40	65	39	45	48	71	141	49	79	100	143	108	19	65	56	110	87	97	167	49	102	75	79	..	..	..
1879	1,233	1,248	49	11	29	196	765	609	349	240	155	57	11	1	2,481	100	182	1,545	801	135	139	104	63	70	78	41	115	67	36	50	37	27	50	56	136	34	88	110	143	105	41	60	75	91	70	85	186	64	116	75	69	..	..	..
1880	1,325	1,367	54	16	34	196	877	634	421	241	151	58	7	1	2,692	75	265	1,816	767	109	157	104	72	76	83	39	139	65	43	53	28	32	47	55	144	55	94	132	139	121	34	64	66	113	77	97	163	70	141	103	83	..	..	..
1881	1,358	1,410	61	11	32	199	900	684	441	230	147	56	4	..	2,768	91	215	1,858	789	101	155	100	68	67	83	33	149	66	37	62	43	42	55	68	142	62	81	107	133	117	28	71	60	141	89	110	177	78	128	96	95	..	..	..
1882	1,382	1,427	58	22	27	177	938	682	407	276	153	62	9	..	2,809	96	198	1,877	797	135	136	104	68	81	80	37	124	50	28	55	19	45	59	45	138	61	71	104	141	142	53	89	85	13	118	114	223	68	130	80	101	..	..	..
1883	1,343	1,455	65	10	18	203	895	668	445	264	150	66	13	1	2,798	...	199	1,890	796	112	130	100	62	86	83	29	123	49	29	52	42	49	49	67	153	48	83	113	134	139	33	80	59	149	121	121	200	87	141	101	80	..	..	..
1884	1,395	1,406	85	14	31	208	845	711	414	258	149	72	13	1	2,801	...	207	1,893	838	70	140	122	80	76	84	35	112	44	28	55	31	49	49	50	126	48	76	104	170	115	55	95	56	148	112	114	223	73	139	97	95	..	..	..
1885	1,346	1,475	57	26	40	193	928	671	411	250	155	74	14	2	2,821	...	219	1,915	769	137	135	93	63	86	86	38	123	62	30	74	45	45	47	66	136	38	67	87	149	157	40	111	55	117	116	107	205	93	136	89	95	..	..	..
Total	29,480	30,427	1,895	649	722	4,492	18,513	14,532	9,051	5,422	3,243	1,328	216	19	59,907	...	4,327	...	18,189																																					
Per cent.	49·6	50·4	3·15	1·08	1·20	7·47	30·80	24·19	15·06	9·02	5·40	2·21	·37	·03																																							

TABLE IV.

Philadelphia—1861–'73:	
Total mortality	201,221
Phthisis	26,864
Per cent	13·35
	Per cent.
1807–'26	15·04
1826–'46	14·48
1847–'60	13·26
1861–'73	13·35
1874–'83	14·86
1807–'73	14·17
Pittsburgh, 1875–'85	9·2
Scranton, 1885	7·33

TABLE V.

1873.				1881.			
WARD	Persons living to one death from any cause.	WARD	Persons living to one death from any cause.	WARD	Persons living to one death from any cause.	WARD	Persons living to one death from any cause.
9	72·30	7	43·52	22	60	8	44
23	65·68	17	43·38	12	59	16	42
13	63·55	28	43·20	23	57	25	41
14	61·03	25	42·26	21	57	19	40
16	59·00	5	42·19	14	55	28	40
10	55·90	3	42·17	9	55	17	40
8	55·57	26	42·12	10	55	11	40
22	54·20	18	40·43	15	55	1	39
6	53·61	24	39·51	13	54	3	37
21	52·30	1	37·47	30	50	27	37
12	51·60	4	36·32	20	49	7	37
15	50·79	19	31·35	6	48	18	36
20	48·99			24	47	2	35
27	48·70			29	46	5	32
2	46·42			26	44	4	31
11	44·71			31	44		

1873. One death from phthisis in every 318 of the population. Deaths from phthisis in each month, arranged in the order of their mortality:

March	258	July	195	April	175
February	243	May	185	September	150
January	227	November	184	August	142
October	220	June	181	December	132

TABLE VI.

Consolidated Abstract of Deaths in Pittsburgh, from Phthisis, for the eleven years ending 1885.

POPULATION.		NATIVITY.						AGE.										TOTAL BY SEXES.			
		UNITED STATES.				Foreign.															
		White		Black.																	
		Male.	Female.	Male.	Female.	Male.	Female.	Under 5 years.	5 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.		Males.	Females.	Total, both sexes.	Deaths from all causes.
	1875	76	77	14	8	69	72	18	27	106	66	41	35	16	6	1		159	157	316	2,957
	1876	68	85	9	12	94	57	...	55	93	63	44	30	35	5	...		171	154	325	2,896
	1877	53	95	9	9	79	50	8	30	84	80	45	22	16	9	...		141	154	295	3,408
	1878	72	88	6	12	71	60	..	32	99	80	51	30	16	1	...		149	160	309	3,068
	1879	60	71	3	6	66	47	1	21	84	65	37	23	16	5	1		129	124	253	2,923
156,389..	1880	68	97	6	7	76	60	...	42	97	81	41	31	20	2	...		150	164	314	3,410
	1881	86	96	8	5	89	62	...	28	106	87	65	29	26	5	...		183	163	346	4,493
	1882	67	77	12	12	85	60	1	26	90	78	57	37	20	4	...		164	149	313	4,090
	1883	85	77	16	15	80	65	1	30	101	94	48	43	19	2	...		181	157	338	3,318
	1884	92	86	15	10	92	58	...	39	110	82	65	34	21	2	...		199	154	353	3,753
185,000..	1885	82	91	19	13	105	70	1	36	128	96	57	37	21	4	...		206	174	380	3,840
Total.	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1,832	1,710	3,542	38,156

Deaths from phthisis to total deaths, eleven years, 9·2 per cent.

Persons living in 1880 to one death from phthisis, 497.

Pittsburgh, 1873–1879:

April	225	February	191	July	169
May	217	June	186	October	166
March	216	August	173	November	162
January	198	December	171	September	146

TABLE VII.

Relative Purity of Water Supply in Philadelphia. Furnished by John L. Ogden Esq., Chief Engineer.

SOURCE OF SUPPLY.	Pumping Stations.	Reservoirs.	Wards supplied.	Order of excellence.*
Schuylkill River.	Fairmount.	Fairmount.	5, 6, 7, 8, 9, and 10.	Fifth.
	Spring Garden & Fairmount.	Corinthian.	1, 2, 3, 4, 26, 30, 11, 12, 13, 14, 16, 19, and part of 20.	Third.
	Spring Garden.	Direct pumpage into mains.	15, 28, 29, and part of 20.	Third.
	Belmont.	Belmont.	24 and 27.	Fourth.
	Roxborough.	Roxborough.	21, 22, and part of 25.	Second.
Delaware and Schuylkill combined.	Kensington and Spring Garden.	Lehigh.	17, 18, 31, and part of 25.	Sixth.
Delaware River.	Frankford.	Frankford.	23 and part of 25.	First.

* See a report upon a chemical examination of the water supplied to the city of Philadelphia, by Professors Mallet, Wormley, and Greene, 1885.

RECORDS OF TEMPERATURE, RAIN-FALL, ETC., FROM TWENTY TOWNS IN PENNSYLVANIA, viz.:

Philadelphia; West Chester, Chester County; Fallsington, Bucks County; Quakertown, Bucks County; Drifton, Luzerne County; Wilkesbarre, Luzerne County; North Mountain, Luzerne and Sullivan Counties; Tamaqua, Schuylkill County; Schuylkill Haven, Schuylkill County; Pittsburgh, Alleghany County; Erie, Erie County; Catawissa, Columbia County; Chambersburg, Franklin County; Dyberry, Wayne County; Leetsdale, Beaver County; Grampian Hills, Clearfield County; Carlisle, Cumberland County.

From Records of the Philadelphia Station, United States Signal Service.

	BAROMETER. Elev., 52·419.				THERMOMETER. Elev., 98·97.				Rain-fall.	Cloudiness, mean.	HUMIDITY.			
	7 A. M.	3 P. M.	11 P.M.	R'nge	A.M.	P.M.	P.M.	Mean.			A. M.	P. M.	P. M.	Mean.
	Deg.	Deg.	Deg.	Deg.	°	°	°	°	Ins.	Tenths.	Per c.	Per c.	Per c.	Per c.
1872..	30·019	29·956	29·990	·823..	48·3	57·4	50·3	52	47·83	5·39	70·25	54·45	69·27	64·66
1873..	30·013	29·957	29·993	.....	48·2	56·5	49·9	51·5	54·62	5·8	72·3	57·1	69·6	66·3
1874..	30·066	30·020	30·043	.....	49·2	57·9	50·7	52·6	46·31	5·2	72·0	54·9	70·1	65·7
1875..	30·033	29·973	30·006	.....	46·7	55·2	48·3	50·1	40·19	4·79	72·9	57·5	70·7	67
1876..	30·013	29·954	29·989	.....	49·2	57·7	50·5	52·5	47·38	4·92	73·5	57·4	71	67·3
1877..	30·023	29·955	30·000	.....	50·4	59·4	52·0	53·9	37·26	5·21	75·2	58·9	73	69·2
1878..	29·962	29·909	29·943	.....	51·2	59·8	52·7	54·6	34·53	4·9	74·28	57·6	73	68·3
1879..	30·045	29·990	30·028	.....	49·8	58·8	51·6	53·4	36·75	4·7	76·1	59·6	74·6	70·1
1880.	.....	.....	.....	.....	50·5	60·5	52·5	54·5	33·64	4·8	71·1	54·5	73	68
1881..	.....	.....	.....	.....	50	60·2	52·4	54·2	30·21	5·2	79·9	58·3	75	71·3
1882..	.....	.....	.....	.....	51	59·5	53·4	54·6	45·58	5·2	74·9	57·3	72·2	68·1
1883..	.....	.....	.....	.....	49·7	59	52	53	39·17	4·7	82	70	82·3	78·1
1884..	.....	.....	.....	.....	49·5	59	51	53	39·34	5	81·8	66·6	79·8	76·1
1885..	.....	.....	.....	.....	47	57	49	51	33·35	4·6	76	57·4	74	69
Aver.	.....	.....	.....	.....	....	....	....	52·2	40·44	5·03	.....	.....	.....	69·2

From Records of the Philadelphia Station, United States Signal Service.—(Continued.)

	WIND DIRECTIONS. Per cent.									DAYS.		
	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Calm.	Clear.	Fair.	Cloudy.
1872.....	12	12	7	4	5	20	15	23	2	93	158	115
1873.....	8	16	9	5	5	20	12	21	2	88	143	134
1874.....	12	10	12	4	6	20	15	17	4	136	127	102
1875.....	12	11	14	3	8	16	16	19	1	122	148	95
1876.....	14	7	15	4	6	15	16	20	2	65	115	186
1877.....	15	12	13	3	6	15	19	15	0·5	83	110	172
1878.....	10	14	8	4	8	21	15	19	1	99	116	127
1879...	9	12	5	3	10	22	12	16	1	132	136	97
1880.....	10	13	6	3	9	17	14	17	0·5	121	142	103
1881.....	15	12	15	4	6	11	21	15	1	118	133	114
1882.....	8	16	6	5	7	18	12	22	2	100	161	104
1883.....	10	19	4	6	7	23	9	20	2	123	154	88
1884.....	13	17	3	5	14	16	7	20	0·3	109	159	98
1885.....	9	14	4	5	13	14	13	22	4·7	109	188	68
Average..	11·2	13·2	8·6	4·1	7·8	17·6	14	19·1	1·9	107	142·2	114·8

The annual mean temperature in Philadelphia from 1800 to 1885, inclusive, with the annual amount of rain and snow, in inches, from 1825 to 1885.

YEARS.	Mean annual temperature.	Rain, in inches.	YEARS.	Mean annual temperature.	Rain, in inches.
	Degrees.			Degrees.	
1800	51·50	....	1843	51·50	46·25
1801	52·00	....	1844	53·00	39·00
1802	53·50	....	1845	54·00	40·25
1803	52·00	....	1846	54·00	44·87
1804	51·00	....	1847	53·86	45·09
1805	51·50	....	1848	54·80	35·00
1806	51·50	....	1849	53·10	42·09
1807	52·00	....	1850	54·00	54·54
1808	52·00	....	1851	54·04	35·50
1809	51·00	....	1852	54·04	46·20
1810	51·00	....	1853	55·44	42·96
1811	52·00	....	1854	55·38	45·23
1812	51·00	...	1855	54·53	44·65
1813	50·50	....	1856	51·92	33·52
1814	51·00	....	1857	53·48	48·45
1815	51·25	....	1858	55·20	41·06
1816*	49·00	....	1859	54·49	54·75
1817	52·50	....	1860	54·12	45·40
1818	53·00	....	1861	54·71	45·41
1819	51·00	....	1862	53·58	45·66
1820	51·75	....	1863	54·13	49·64
1821	51·50	....	1864	54 60	46·73
1822	53·00	....	1865	55·77	53·64
1823	53·50	....	1866	54·90	43·57
1824	53·75	....	1867	53·41	62·93
1825	54·00	29·30	1868	52·83	50·18
1826	53·00	40·00	1869	54·23	44·16
1827	50·00	39·50	1870	56·44	43·56
1828	54·00	38·50	1871	54·91	45·98
1829	53·00	42·00	1872†	54·85	49·02
1830	52·50	44·75	1873	51·4	54·62
1831	53·00	41·00	1874	52·6	46·31
1832	51·00	39·25	1875	50·3	40·24
1833	52·50	48·38	1876	52·6	47·39
1834	52·25	33·00	1877	54·2	37·36
1835	52·00	39·50	1878	54·7	34·53
1836	50·25	43·00	1879	53·6	36·75
1837	52·25	37·10	1880	54·6	33·58
1838	53·00	44·25	1881	54·2	30·21
1839	52·00	44·75	1882	54·6	45 58
1840	52·25	47·50	1883	53·5	39·17
1841	51·50	55·50	1884	53·5	39·34
1842	52·75	47·50	1885	51·0	33·35

* Ice in every month; the coldest year on record in the city; the year without a summer.

† From this year observations taken at United States Signal Office used in this department.

Temperature: Mean for 86 years, 52·92 Fahr.

Rain-fall: Mean for 61 years, 43·25 in.

Mean Monthly and Annual Rain-fall at West Chester, Pa.

YEAR.	1st month.	2d month.	3d month.	4th month.	5th month.	6th month.	7th month.	8th month.	9th month.	10th month.	11th month.	12th month.	Year.	Mean annual temperature.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	Deg.
1875.	3·84	4·22	5·12	2·72	2·09	4·96	3·84	9·67	3·12	2·11	6·10	4·35	52·14	47·78
1876.	2·30	4·56	7·49	2·11	4·26	2·32	7·21	1·32	12·33	2·50	4·90	2·76	54·06	50·19
1877.	4·15	2·55	5·86	3·10	0·83	5·08	6·65	1·42	5·07	8·06	8·11	2·05	44·10	51·63
1878.	5·22	4·00	3·71	3·89	4·32	4·16	4·35	2·90	3·06	3·22	3·83	5·84	40·41	52·05
1879.	2·88	2·62	2·73	5·19	1·38	4·13	2·60	6·10	2·20	0·60	1·63	6·13	38·19	45·17
1880.	2·92	3·01	4·71	3·69	1·35	1·91	6·90	3·18	1·49	2·28	2·90	6·65	40·99	51·59
1881.	5·18	5 99	6·36	1·10	2·59	5·60	1·77	0·94	1·53	3·00	3·08	4·39	34·60	51·91
1882.	6·38	4·95	4·61	2·36	6·94	1·50	2·80	4·38	7·23	1·15	1·42	1·98	45·70	50·46
1883.	4·52	5·48	3·62	3·52	2·71	5·72	2·54	5·20	3·64	4·45	2·30	4·63	40·27	49·53
1884.	7·32	7·29	6·09	2·94	3·64	7·52	5·27	2·12	0·42	2·56	4·36	7·05	56·58	50·72
1885.	4·65	6·39	1·34	2·20	4·07	1·26	0·93	9·51	1·49	6·25	4·71	4·18	46·98	49·19

WEST CHESTER, PA., *April 12, 1886.*

DEAR DOCTOR: The above is the mean monthly and annual rain-fall and mean annual temperature, taken from my "meteorological observations," as requested in thy letter of the 7th inst.

Height of rain-gauge above tide-water, 450 feet.

Thine truly,

J. C. GREEN.

Dr. WM. PEPPER, *Philadelphia.*

Carlisle.

	DAYS.			
	Fair.	Cloudy.	Rain.	Snow.
1843	205	160	91	19
1844	202	164	75	16
1845	214	151	68	20
1848	218	148	71	4
1849	244	122	68	20
1850	191	174	89	20
1852	179	187	93	26
Mean	207	158	92	19

Pittsburg, 1825–'54, 50·86°; rain-fall, 1837–'54, 34·96 inches.

Carlisle, 1840–'54, 51·10°; rain-fall, 1849–'54, 34·01 inches.

Carlisle Barracks (now the site of the Indian Industrial School) is situated in a beautiful valley ten miles wide, about midway between the north and south mountain spurs of the Alleghany range, five miles from the mountains. A small marshy tract of land (the only one in the vicinity) lies north of the barracks some three or four hundred yards. There is also a boggy tract along the Leitart Creek. This tract has been, at times, partially submerged.—From "Report on Mortality, U. S. A." Coolidge.

Fallsington, Bucks County, Pa.

MONTH.	Highest barometer during month.	Lowest barometer during month.	Mean barometer for month.	Highest temperature during month.	Lowest temperature during month.	Mean temperature for month.	Prevailing winds during month.	Total rainfall or melted snow during month.	No. of days on which 0·01 or more rain fell, sn'w m'l'd	No. of days on which cloudiness averaged 8 or more on a scale of 10	No. of thunder-storms during month.	No. of days on which frost occurred.	Snow-fall.
1879.													
July	30·13	29·43	29·825	97	63	75·00	S. W.	5·59	9	5	7	0	·00
August	30·02	29·60	29·875	92	59	71·70	"	8·80	11	8	4	0	·00
September	30·28	29·63	29·995	87	43	62·75	N., S. W.	1·48	6	5	14	2	·00
October	30·59	29·47	29·996	86	29	59·50	S.W., N.W.	·48	5	4	0	5	·00
November	30·41	29·43	30·029	74	15	40·03	N. W.	1·78	9	6	0	14	1·75
December	30·51	29·62	30·045	63	12	37·50	S.W., N.W.	5·98	14	12	0	7	3·00
1880.													
January	30·54	29·49	30·089	64	6	39·80	N. W., N. E.	2·72	9	12	1	13	5·00
February	30·49	29·15	30·003	66	13	37·35	N.W., S.W.	2·34	10	9	0	7	4·00
March	30·35	29·32	29·959	73	21	38·16	N. W.	5·27	14	12	0	5	6·50
April	30·25	29·51	29·916	82	31	52·00	N. W., S.W.	3·98	12	7	4	6	·00
May	30·23	29·70	29·963	97	40	68·25	S. W.	·78	3	4	0	0	·00
June	30·17	29·55	29·896	94	62	72·66	S.W., N. W.	2·08	11	4	4	0	·00
July	30·06	29·63	29·883	92	62	77·85	S. W.	12·51	13	10	7	0	·00
August	30·32	29·65	29·956	92	58	72·15	"	3·10	10	9	3	0	·00
September	30·25	29·60	29·936	90	48	65·20	"	2·64	7	5	1	0	·00
October	30·31	29·42	30·026	80	34	50·50	N. W.	2·25	8	7	0	11	·00
November	30·63	29·58	30·153	66	12	38·80	"	2·27	8	10	0	17	5·25
December	30·39	29·56	29·963	47	−8	26·88	"	4·45	11	10	0	13	20·75
1881.													
January	30·56	29·32	30·073	46	−14	25·45	"	4·94	9	11	0	7	9·00
February	30·71	29·38	30·116	58	Zero.	29·85	"	4·20	11	9	1	9	8·00
March	30·25	29·10	29·713	62	24	39·00	"	4·09	9	11	1	13	1·50
April	30·25	29·43	29·833	79	24	48·00	"	·71	6	9	2	4	0·25
May	30·37	29·59	29·983	92	47	64·32	S. W.	3·04	13	9	6	0	·00
June	30·09	29·62	29·843	89	53	67·03	N. W.	4·71	14	10	5	0	·00

Fallsington, Bucks County, Pa.—(Continued).

MONTH.	Higest barometer during month.	Lowest barometer during month.	Mean barometer for month.	Highest temperature during month.	Lowest temperature during month.	Mean temperature for month.	Prevailing winds during month	Total rainf'll or melted snow during month.	No. of days on which 0·01 or more rain fell, or w m'l'd sn'w	No. of days on which cloudiness averaged 8 or more on a scale of 10	No. of thunder-storms during month.	No. of days on which frost occurred.	Snow-fall.
1881.													
July	30·16	29·60	29·873	92	65	75·25	N. W.	1·13	4	6	4	0	·00
August	30·24	29·61	29·953	97	62	74·50	S. W.	1·44	7	5	3	0	·00
September	30·25	29·82	30·023	103	55	74·00	"	·64	4	6	1	0	·00
October	30·47	29·47	30·070	88	31	59·50	"	2·00	11	12	0	7	·00
November	30·59	29·61	30·113	64	25	46·50	N. W.	2·85	10	11	0	11	·00
December	30·54	29·38	30·096	63	22	44·50	"	3·32	11	12	0	13	·00
1882.													
January	30·76	29·33	30·116	48	2	30·15	"	5·02	12	15	0	11	12·65
February	30·66	29·45	30·096	58	15	35·00	"	4·99	9	9	2	10	8·00
March	30·62	29·59	30·050	64	24	42·00	"	2·31	12	9	1	5	2·50
April	30·45	29·39	29·990	75	29	42·00	"	2·37	8	9	2	5	·00
May	30·38	29·49	29·980	83	40	56·25	S. W.	5·14	14	14	1	3	·00
June	30·18	29·53	29·863	93	57	70·50	"	2·30	10	3	5	0	·00
July	30·25	29·60	29·973	95	60	75·50	S. W.	1·69	7	5	3	0	·00
August	30·25	29·61	29·994	91	57	72·50	"	5·03	12	9	1	0	·00
September	30·23	29·60	30·013	90	52	67·50	N. E.	12·35	10	9	4	0	·00
October	30·28	29·74	30·060	76	39	59·00	"	1·96	14	13	1	2	·00
November	30·43	29·69	30·123	73	19	40·75	N. W.	1·63	9	9	0	15	8·50
December	30·41	29·68	30·090	48	11	30·00	"	2·02	6	7	0	20	·00
1883.													
January	30·58	29·55	30·160	44	2	27·50	N. E.	4·07	19	18	1	8	14·00
February	30·68	29·74	30·243	60	6	32·50	N. W.	4·60	15	7	0	8	8·15
March	30·45	29·32	29·962	64	11	35·00	"	2·60	8	6	0	12	2·50
April	30·42	29·65	30·008	72	32	48·25	N. E., N.W.	3·88	14	8	3	5	·00
May	30·33	29·45	29·955	85	45	61·15	N. W.	3·34	12	8	4	1	·00
June	30·42	29·63	29·970	91	52	72·00	S. W.	5·04	14	7	5	0	·00

Fallsington, Bucks County, Pa.—(Continued).

MONTH.	Highest barometer during month.	Lowest barometer during month.	Mean barometer for month.	Highest temperature during month.	Lowest temperature during month.	Mean temperature for month.	Relative humidity—mean during month.	Prevailing winds during month.	Total rainf'll or melted snow during month.	No. of days on which cloudiness averaged 8 or more on a scale of 10	No. of days on which 0·01 or more rain fell, or w'h'd sn'w m'lt'd	No. of thunder-storms during month.	No. of days on which frost occurred.	Snow-fall.
1883.														
July.....	30·20	29·75	29·966	93	57	74·25	....	S. W.	2·05	9	4	2	0	·00
August....	30·24	29·67	30·020	91	52	68·00	....	N. W.	5·36	6	5	3	0	·00
September..	30·41	29·52	30·056	84	42	63·25	....	S. W.	3·64	10	9	3	4	·00
October....	30·58	29·46	29·948	81	35	53·50	...	N. E.	4·02	14	10	1	6	·00
November..	30·57	29·73	30·134	74	18	44·00	....	S. W.	1·56	7	9	0	15	·00
December..	30·63	29·53	30·096	56	3	33·25	....	N. W.	3 31	14	13	1	19	15·25
1884.														
January....	30·79	29·17	30·110	47	4	26·00	....	"	4·90	15	11	0	14	11·65
February..	30·70	22·29	30·080	64	8	37·00	....	"	5·04	18	15	1	6	4·60
March.....	30·40	29 55	30·005	63	8	39·75	....	"	4·79	17	18	1	6	7·75
April.....	30·15	29·18	29·864	73	33	49·54	....	"	2·25	8	8	2	3	·00
May	30·25	29·65	29·948	87	46	61·25	....	"	4·48	13	5	3	1	·00
June.....	30·46	29·76	30·072	93	53	70·50	....	S. W.	5·30	8	3	2	0	·00
July.....	29·98	29·65	29·860	91	62	71·75	....	N. W.	4·24	15	7	2	0	·00
August.....	30·27	29·75	30·044	93	56	71·86	....	S. W.	4·58	10	5	3	0	·00
September..	30·44	29·76	30·099	92	48	69·50	....	"	0·22	3	1	1	0	·00
October....	30·54	29·77	30·132	81	31	54·58	71·849	"	2 30	12	9	1	7	·00
November..	30·42	29·52	30·056	62	20	40·50	74·396	N. W.	3·12	7	7	0	17	·25
December..	30·61	29·55	30·140	62	Zero.	32·75	80 530	S. W. to N.	6·00	14	10	0	11	7·35
1885.														
January....	30·75	29·38	30 099	57	4	28·62	69·670	N. W.	4·03	9	6	0	11	3·45
February...	30·45	29·16	29·967	40	—1	21·13	80·000	"	4·91	14	5	1	8	17·15
March.....	30·45	29·62	30·043	59	7	29·14	68·530	"	1·19	9	5	1	12	7·25
April.....	30·56	29·55	30·042	84	29	48·75	67·596	S. W.	2·30	10	6	1	7	·00
May.....	30·24	29·65	29·975	83	42	57·25	74·420	N. E.	1·51	11	5	2	2	·00
June.	30·26	29·53	30·005	92	55	68·75	71·500	S. W.	1·02	5	0	2	0	·00

Fallsington, Bucks County, Pa.—(Concluded).

MONTH.	Highest barometer during month.	Lowest barometer during month.	Mean barometer for month.	Highest temperature during month.	Lowest temperature during month.	Mean temperature for month.	Relative humidity—mean during month.	Prevailing winds during month.	Total rain'f'll or melted snow during month.	No. of days on which cloudiness averaged 8 or more on a scale of 10	No. of days on which ·01 or more rain fell, sn'w m'lt'd	No. of thunder-storms during month.	No. of days on which frost occurred.	Snow-fall.
1885.														
July.....	30·16	29·72	29·968	97	59	74·00	77·287	S. W.	4·05	12	1	5	0	·00
August. ...	30·25	29·72	29·997	90	51	69·25	83·997	"	7·56	13	5	9	0	·00
September..	30·35	29·48	30·254	82	42	61·75	79·700	"	1·07	7	3	2	0	·00
October....	30·26	29·20	30·033	75	34	51·65	82·440	N. W.	4·23	13	6	2	11	·00
November..	30·34	29·64	29·932	70	26	43·25	80·577	"	3·58	12	8	0	17	0·20
December..	30·70	29·25	30·017	58	10	34·25	77·570	"	3·26	11	5	0	13	0·10
1886.														
January....	30·77	28·82	30·058	56	—3	25·75	81·255	"	4·12	13	9	0	5	10·25
February...	30·47	29·40	30·070	63	—5	27·75	80·678	"	5·67	9	6	0	10	9·10
March	30·48	29·38	29·902	65	12	37·00	76·967	"	3·53	13	7	2	10	·00

Rain-gauge, Signal Service, 10 inches from the ground.
Thermometers, Signal Service, authorized, wet bulb.
Thermometers, Signal Service, authorized, dry bulb, 47 feet above sea-level.
Thermometers, Signal Service, maximum and minimum, 47 feet above sea-level.
Barometer, Woodruff's; iron cistern; readings reduced; bulb 44 feet above sea-level.
Height of ground, 41 feet above sea-level.

Milnor Gillingham.

Fallsington, Bucks County, Pa.

The following is a tabular statement of the records of the weather, kept at Quakertown, Bucks County, Pa., for five years ending December 31, 1885, by J. L. Heacock.

	Highest temperature.	Lowest temperature.	Average temperature.	Greatest temperature, mean.	Lowest temperature, mean.	Daily range of temperature, greatest.	Daily range of temperature, least.	Daily range of temperature, average.	Monthly range of temperature.	Amount of rainfall and melted snow.
1881.										
January	41	—13	23·12	31·51	14·77	35	7	16·74	54	3·40
February	51	—5	27·64	35·60	18·96	26	6	17	56	4·01
March	56	18	35·16	41·64	28·70	25	3	12·93	38	4·46
April	83	18	45·38	53·80	35·26	36	2	19·53	65	·69
May	90	32	68·64	73·29	51·16	29	9	21·51	58	5·12
June	87	46	64·06	74·23	54·23	29	7	19·66	41	4·10
July	91	55	72·70	83	62·40	30	9	21	36	·73
August	97	54	73·16	84·80	60·90	32	9	24·32	43	·27
September	102	48	72·60	83·20	62	33	3	20·53	54	·89
October	88	28	57·51	67·93	47·09	33	3	20·48	60	1·57
November	66	22	43·33	50·80	35·30	27	4	15·50	44	2·15
December	62	18	39·13	46·39	30·93	34	3	15·45	44	4·71
Averages and rainfall for year	76·15	17·50	51·87	60·52	41·81	31	5	18·72	49·42	32·10
1882.										
January	47	—2	26·70	32·87	20·48	20	5	12·39	49	2·95
February	54	12	32·57	41·07	24·10	29	5	16·96	42	4·18
March	61	20	37·45	45·87	29·70	29	8	16·22	41	4·47
April	70	22	44·56	54·26	34·73	32	7	19·43	48	2·20
May	80	32	52·58	62·32	44·16	29	4	19·94	48	7·30
June	89	44	66·60	77·43	55·76	33	9	21	45	3·00
July	92	49	71·29	81·51	61·22	30	6	20	43	1·95
August	88	46	69·32	79·29	59·38	30	11	19·90	42	3·95
September	86	40	65·83	70·44	56·22	40	7	18·78	46	7·25
October	73	33	54·89	62·36	47·43	28	5	14·93	40	1·85
November	70	15	38·86	46·53	30·09	29	7	15·30	55	·65
December	46	5	29·06	36·19	20·19	26	1	13·90	41	1·20
Averages and rainfall for year	71·33	26·33	49·14	57·51	40·29	29·51	6	17·39	45	40·95

Remarks: This town is elevated on an average 516 feet above sea-level. Observations of temperature are taken from a self-registering thermometer, and the mean is for twenty-four hours.

Records of the weather at Quakertown, Bucks County, Pa.—(Continued).

	Highest temperature.	Lowest temperature.	Average temperature.	Greatest temperature, mean.	Lowest temperature, mean.	Daily range of temperature, greatest.	Daily range of temperature, least.	Daily range of temperature, average.	Monthly range of temperature.	Amount of rainfall and melted snow.
1883.										
January	42	1	23·29	29·94	16·68	26	4	13·26	40	3·40
February	48	7	28·21	35·57	20·86	29	2	14·36	41	3·20
March	59	1	31·60	40·58	22·32	34	8	18·26	58	1·69
April	66	19	43·87	54·23	35·76	27	3	18·46	47	2·65
May	78	35	57·03	68·03	46·03	31	10	22·32	43	2·09
June	85	53	67·60	77·73	57·76	29	5	19·76	32	6·98
July	90	49	70·39	80·45	60·29	25	9	20·74	41	1·05
August	86	50	66·13	76·87	55·29	29	8	21·29	36	2·25
September	79	37	59·33	69·33	49·70	33	6	19·63	42	3·72
October	77	28	50·26	58·74	41·84	30	4	16·87	49	4·10
November	68	16	41·33	49·43	33·16	30	5	16·33	52	1·47
December	52	4	30·66	38·13	22·03	32	4	16·09	48	2·15
Averages and rainfall for year	69·17	25	47·47	56·59	38·47	29·58	5·66	18·11	44·08	34·75
1884.										
January	42	−2	22·55	30·09	15·06	30	3	15·42	44	2·96
February	52	2	32·34	38·51	26·21	27	4	9	50	4·74
March	59	−2	34·19	41·97	25·80	30	4	15·63	61	4·99
April	68	28	46·06	55·20	35·23	31	9	18·56	40	2·70
May	81	37	57·59	66·80	48·19	35	5	20·19	44	3·53
June	88	41	66·53	78·26	55·76	36	8	21·16	47	6·54
July	86	52	67·55	76·22	59·20	28	7	17·09	34	7·92
August	88	45	68·32	77·48	59·13	26	7	18·36	43	3·76
September	89	39	65·86	76·66	54·90	31	13	22	50	·53
October	78	27	53·26	62·77	43·77	30	4	19	51	4·38
November	60	17	40·03	48·70	31·43	29	3	17·26	43	3·53
December	52	0	30·36	36·64	24·09	25	3	12·22	52	6·46
Averages and rainfall for year	70·25	23·66	48·72	57·44	39·90	29·83	5·83	17·16	46·83	52·04
1885.										
January	57	0	27·39	36·06	18·83	40	1	16·42	57	4·52
February	45	−4	19·82	28·35	11·91	27	9	17·05	49	4·38
March	52	2	26·38	34·55	18·23	25	7	16·61	50	1·21
April	82	24	45·10	57·20	35	36	11	22·20	58	2·79
May	80	31	55·45	65·06	46·16	34	10	18·90	49	2·32
June	89	42	77·13	57·03	29·06	33	8	21·10	47	·81
July	96	48	72	....	....	..	..	....	..	1·26
August	88	44	67·45	75·77	59·03	24	3	16	44	8·34
September	87	26	56·50	....	....	..	..	....	..	·52
October	72	26	49	....	....	..	..	....	..	4·29
November	64	20	40·07	46·99	34·06	22	0	12·90	44	4·23
December	48	8	31·16	38·13	24·51	25	7	13	40	3·15
Averages and rainfall for year	71·67	22·25	47·45	....	....	..	..	....	..	37·82

Statements taken from the voluntary Signal-Service observations made by H. D. Miller, Superintendent of Drifton Hospital, Drifton, Luzerne County, Pa.

Latitude of station, 41° 1′ 1″ north.
Longitude of station, 1° 4′ 48″ east of W.
Height of station above the sea, 1,655 feet.

MONTH.	Highest temperature.	Lowest temperature.	Mean temperature.	Snow-fall.	Rain and melted snow fall.
1884.					
February	56	—8	27·3	8·25	4·30
March	65	—8	29	5·50	4·04
April	73	24	40·48	23	4·36
May	88	32	53·07	....	3·62
June	92	41	65·70	....	2·88
July	89	47	64·08	....	6·77
August	91	40	66·34	....	4·79
September	91	37	63·08	....	2·50
October	81	22	49·45	....	2·67
November	68	14	37·76	....	3·83
December	62	—8	30·46	12·5	4·76
1885.					
January	62	—9	24·07	11·5	5·25
February	45	—16	15·85	31	3·39
March	51	—6	21·54	5·5	·76
April	85	18	43·77	4·25	1·99
May	85	31	56·36	....	2·30
June	87	41	64·79	....	2·00
July	97	42	70·39	....	2·70
August	90	40	65·06	....	7·44
September	82	38	59·09	....	1·39
October	77	27	48·72	....	5·66
November	72	12	37·39	27·5	5·46
December	56	—4	28·12	2·75	2·82
1886.					
January	60	—12	20·69	21·75	6·42
February	59	—12	36	1·5	3·47
March	65	—3	31·83	8	5·15

The record for April has not yet been made up.

H. D. Miller.

Rain-fall, Franklin, Venango County, Pa. Recorded by Joseph Bell.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875..	2·56	1·56	4·56	2·81	3·25	4·62	3·32	5·62	4·62	4	4	5·25	46·17
1876..	4	4·18	4·81	3·31	1·68	3·50	4·38	2·50	9·56	2·25	3·18	3·50	46·85
1877..	4·18	1·56	6·26	1·20	4·07	6·52	6·72	1·10	3·06	4·06	5·53	2·32	42·98
1878..	3·67	2·03	2·08	2·74	2·76	2·91	5·66	·84	6·71	2·04	3·26	5·42	38·12
1879..	3·48	5·11	3·10	1·89	·86	3·27	3·75	1·55	2·27	1·95	5·41	5·02	36·67
1880..	3·64	2·92	2·61	2·21	2·78	4·94	1·83	3·81	2·32	2·40	2·62	2·50	34·58

Average rain-fall, 6 years, 40·93 in.

Wilkesbarre, Luzerne County, Pa.

Latitude, 41° 14′ 40·4″. Longitude, 1° 10′ 4·6″. Altitude, 543·1 feet.

Statement of the monthly and annual temperature, mean, maximum, and minimum, together with the rain-fall.

MONTH.	1881.			1882.			1883.			1884.			1885.			RAIN AND MELTED SNOW IN INCHES.					
	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	1881.	1882.	1883.	1884.	1885.	Aver.
January.....	24·2	44	−8	27·8	47	−5	22·8	38	−6	21·6	50	−9	24·8	56·5	−7·5	....	3·25	4·98	3·41	5·18	4·22
February.....	27·6	53	−5	33	54	15	28·3	48	11	32·4	59	−1	17·8	45	−12	....	5·37	2·38	3·48	3·27	3·40
March.....	38·9	57	20	39·4	63	21	31·0	62	7	33·8	60·9	−2·5	25·6	57·2	−3	....	2·27	2·55	4·95	·90	2 95
April.....	47·2	83	22	46·6	70	25	46·0	72	26	45·9	76·1	26	46·3	89	21·2	....	2·10	2·70	2·46	2·56	2·40
May.....	68·8	91	42	55·6	85	36	61·5	85	46	58·2	91	32	58·2	89	31	....	6·76	5·35	3·97	2·66	4·68
June.....	66·3	87	51	70·7	91	55	68·4	88	38	70	91	40	67	91	40	4·00	5·76	8·52	2·68	2·71	4·73
July.....	77·8	89	62	72·9	90	57	69·3	92	43	67·2	90	49	72·4	97·2	42	4·58	4·65	7·08	4·62	3·01	4·79
August.....	76·1	92	56	70·6	90	53	65·4	91·5	41	68·7	94	38	66·6	93·4	41·1	1·89	3·69	0·88	2·90	7·92	3·46
September....	75·4	96	53	64·3	86	40	57·8	83·8	30·7	65·6	96	34	59·9	86	38·5	3·35	2·70	3·19	1·40	1·20	2·37
October.....	56·8	89	30	56·6	78	31	49·3	79·7	22	51·6	81·8	23	49·6	83·2	29·5	1·70	1·41	3·12	3·16	4·65	2·81
November....	43·3	64	22	39·5	75	12	41·6	69·8	11·6	38·4	64·1	16·5	39·7	72	12	2·70	1·69	1·45	3·30	5·15	2·86
December....	37·8	58	21	28·8	48	8	30·4	54·5	4·8	30·7	49	−7	32·3	56·4	5	4·83	1·06	2·00	4·53	2·68	3·02
Mean of years.	53·4	..	..	50·5	..	..	47·6	...	...	48·7	....	....	46·7	....	....	23·05	40·71	44·20	40·86	41·89	41·69

The monthly means are made up from the daily means. These are made from three daily observations, at 7 A. M., 2 P. M., and 9 P. M., doubling the 9 P. M. observation, and dividing by 4.

I have no record of rain-fall before June, 1881, and know of none in this city. I have used the record of my friend Judge E. L. Dana in supplementing my own, both in temperature and rain.

In making out the averages of rain-fall for January, February, March, and April, I have added in the fall of these months respectively this year. The May average is only for four years.

Rev. F. B. Hodge,
118 S. Franklin Street.

Temperature at North Mountain, Sullivan and Luzerne Counties. Recorded by Dr. Lewis H. Taylor, of Wilkesbarre, Pa.

July, 1876.				August, 1876.			
DATE.	Max.	Min.	Mean.	DATE.	Max.	Min.	Mean.
1	80	56·5	68·2	1	73	52·5	67·7
2	78·6	60·5	69·5	2	72·5	56	64·3
3	78	63	70·5	3	69·5	62·7	56
4	76	62·5	69·2	4	70	59·5	64·7
5	75	60	67·5	5	81	64	72·5
6	75	60	67·5	6	84	63·5	73·8
7	79·7	54	66·9	7	84	63·5	73·8
8	87	65·5	76·2	8	80	49	64·5
9	87	69·5	78·2	9	79	53·5	66·5
10	85	66	75·5	10	79	56·5	67·8
11	86	63	74·5	11	79·5	58	68·7
12	84	65	74·5	12	80	60·5	70·2
13	84	65	74·5	13	86	60·5	73·3
14	80·2	64	72·1	14	76·5	59·5	68
15	80	63·8	71·9	15	81	64	72·5
16	85	56	70·5	16	77	58	67·8
17	78·8	55	66·9	17	75	61	68
18	81·8	62	71·9	18	76	53	64·5
19	82·5	64	73·2	19	65	61·5	63·2
20	85·2	65·8	74·5	20	68	59	63·5
21	71	56·5	67·7	21	63	41	52
22	72·4	49·5	60·9	22	69·5	41·2	55·3
23	68·9	60·5	64·7	23	75	55·5	65·2
24	63·2	45·6	54·4	24	76	53	64·5
25	63·8	45·8	54·8	25	81	55	68
26	64·8	46·5	55·6	26	70	49	59·5
27	71·8	44	57·9	27	68	47	57·5
28	68·8	58·5	63·7	28	70	47	58·5
29	66·5	56·8	61·7	29, omitted	....	....	....
30	62·8	54·5	58·7	30, "	....	....	....
31	60·7	52	56·3	31, "	....	....	....
Average	....	....	72·8	Average	....	....	64·5

Record showing temperature and rain-fall at Tamaqua and Mahanoy Plane, Schuylkill County, Pa.

MONTH.	Highest temperature.	Lowest temperature.	Mean temperature.	Total rain or melted snow.	No. of days on which 0·01″ fell.	Depth of snow in inches on ground at end of month.	Total snow-fall in month.
TAMAQUA, 1884.							
May	90	46	67·02	4·35	9	..	..
June	100	56	78	3·74	4	..	..
July	94	60	74·5	6·96	10	..	..
August	96	58	76·2	7·13	18	..	..
September	98	53	72	1·36	5	..	..
October	85	32	55·6	2·24	11	..	..
November	60	20	40	2·90	6	1·25	..
December	56	—4	31	7·40	9	..	14·65
1885.							
January	56	0	25·2	4·09	6	5	7
February	42	—12	19·1	1·40	2	..	2·25
MAHANOY PLANE, 1885.							
February	37	3	20·0	2·16	5	..	23
March	55	2	27·9	3·9	2	4	4·50
April	84	26	49·8	2·28	8	..	4·00
May	87	40	61·2	3·42	10	..	..
June	92	52	70	1·04	3	..	..
July	97	58	77·56	1·75	7	..	..
August	89	53	70·2	9·99	12	..	..
September	84	45	64·2	·76	5	..	..
October	74	35	53·0	5·54	10	..	..
November	67	13	41·6	6·78	12	6	24
December	58	8	33·9	4·17	5	..	4
1886.							
January	52	—4	24·8	8·46	10	..	25·75
February	51	6	28·6	5·59	5	..	..
March	64	7	39·7	7·59	6	..	..

Mean annual temperature for 1885 ..... 50·58 degrees.
Annual rain-fall for 1885 ..... 52·24 inches.

Rain-fall in Schuylkill Haven, Schuylkill County, Pa., 1880–1885.

This statement shows the inches and hundredth parts of an inch, and is taken from an accurate water-gauge.

1880	37·93	inches.
1881	42·83	"
1882	35·18	"
1883	38·51	"
1884	43·88	"
1885	34·80	"
Mean	38·85	"

Furnished by WILLIAM H. DECHANT, *Division Engineer, P. & R. R. R. Co. (Mahanoy Plane Div.).*

	Pittsburgh.	Erie.	Philadelphia.	Catawissa, Col. Co.*	Chambersburg, Franklin Co.	Dyberry, Wayne Co.	Leetsdale, Beaver Co.	Quakertown, Bucks Co.†	Grampian Hills, Clearfield Co.	Carlisle, Cumberland Co.	West Chester, Chester Co.‡	State College.
Rain-fall, 1872	31·05	....	See pp. 5 and 6.	....	....	....	....	See p. 12.	....	....	....	....
" 1873	41·4	....		....	....	....	....		....	....	....	....
" 1874	39·4	37·8		....	....	....	....		....	....	....	....
" 1875	34·05	41·2		....	....	....	....		....	....	52	....
" 1876	37	44		....	....	....	....		....	....	54	....
" 1877	34·7	39		....	....	....	....		....	....	44	....
" 1878	38·7	55		....	....	....	....	.....	....	....	40	....
" 1879	57	36·2		....	....	....	....	.....	....	....	38	....
" 1880	32	41	.....	....	....	....	....	.....	....	....	41	....
" 1881	37·3	37·6	.....	....	....	....	....	32	....	....	34	36·81
" 1882	38·6	46·3	.....	....	....	....	....	40	....	....	46	....
" 1883	43·1	44·8	.....	36·74	42·51	38·10	43·70	40·2	....	....	40	....
" mean	37·04	42·39	.....	....	....	....	....	36·86	....	34 ('49–'54)	45 ('75–'85)	....
Mean temperature	51·9 ('72–'79)	49·3 ('74–'79)	.....	49·4 ('83)	....	44·4 ('83)	49·1 ('83)	49·29 ('75–'85)	45·2 ('83)	51·1 ('49–'54)	50·4 ('75–'85)	....
Barometer, reduced to sea-level	30·005 ('72–'79)	29·985 ('74–'79)	.....	....	....	....	....	.....	....	....	....	....
Humidity, per cent	69·9 ('72–'83)	72·3 ('74–'83)	.....	....	....	....	....	.....	....	....	....	....
Dew-point	41·9 ('83)	39 ('83)	.....	....	....	....	....	.....	....	....	....	....
Cloudiness, in tenths ('83)	5·6	6·1	4·7	....	....	....	....	.....	....	....	....	....
Days clear	97	70	123	....	....	....	....	.....	....	....	....	....
" fair	147	149	154	....	....	....	....	.....	....	207	....	....
" cloudy	120	146	88	....	....	....	....	.....	....	158	....	....
" rain	....	....	.....	....	....	....	....	.....	....	92	....	....
Elevation, ft	....	....	.....	....	....	....	....	516	....	....	450	....
Average hourly movement of wind, miles	6 (15 yrs.)	10·2 (10 yrs.)	9·7 (14 yrs.)	....	....	....	....	.....	....	....	....	....

* W. G. Yetter. † J. L. Heacock. ‡ J. C. Green.

Especial reference should here be made to the assistance derived from the following sources in the preparation of this paper:

John S. Billings, M. D., LL. D., Surgeon-General's Office.
Dr. Persifor Frazer, Philadelphia.
Prof. J. Peter Lesley, LL. D., State Geologist, Pennsylvania.
Mr. Charles A. Ashburner, Second Geological Survey, Pennsylvania.
Henry I. Bowditch, M. D., Boston.
Mr. John L. Ogden, Chief Engineer Water Department, Philadelphia.
Dr. Guy Hinsdale, Philadelphia.
Dr. Hobart A. Hare, Philadelphia.
Mr. George E. Chambers, Philadelphia.
Mr. J. C. Green, West Chester.
Mr. Milnor Gillingham, Fallsington, Bucks County.
Mr. J. L. Heacock, Quakertown, Bucks County.
Mr. H. D. Miller, Drifton, Luzerne County.
Rev. F. B. Hodge, Wilkesbarre.
Dr. Lewis H. Taylor, Wilkesbarre.
Mr. William H. Dechant, Mahanoy Plane.
Mr. Joseph Bell, Franklin, Venango County.
Dr. W. H. Mercur, Pittsburgh.
Dr. William D. McGowan, Ligonier.
Prof. I. Thornton Osmond, State College.
Dr. F. Donaldson, Baltimore, Md.
Tenth Census, United States.
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Report on Mortality, U. S. A., Coolidge.
Walker's Statistical Atlas of the United States.

Paper.

HOW THE THERAPEUTIC VALUE OF OUR MINERAL SPRINGS MAY BE INCREASED.

By CLARENCE C. RICE, M. D.

MORE attention has been paid to the mineral springs of the United States and their medicinal virtues during the last few years than ever before; and this is not that we have largely developed new resources, but because there is a demand on the part of the public for this line of therapeutics. Our patients have been educated abroad, and have discovered the benefit of treatment to be derived from mineral waters before the physician himself has become aware of it. The physician meets people constantly who have spent a season at Carlsbad or Ems. In these days of rapid traveling the distance to Europe is not considered a serious obstacle

to one who is willing to be at any trouble to regain his health; and as for expense, it may easily cost as much to remain at home. Just why so many thousand Americans go to European spas for their health, when nature has been so lavish with the same resources here at home, would seem at first thought difficult to explain, but a little inquiry will show that the physician rather than the patient has been at fault, and has been the cause of this vast emigration of our invalids to Europe. The owners of mineral springs and the proprietors of watering-place hotels have also been somewhat to blame, because they have not up to this time furnished the public with the apparatus for using mineral waters which can be found at European spas. There are many Americans who have been under medical care at Wiesbaden and Homburg who, perhaps, are not acquainted with a single American mineral spring, and imagine that people visit Richfield and Saratoga solely because these places are fashionable summer resorts, and not at all on account of the waters to be found there. A number of times I have heard visitors express surprise when they learned, for the first time, that many of the hotel guests were at these places for the sole purpose of taking the baths. I speak of this only to show that Americans are to-day less acquainted with their own than with European mineral springs. Saratoga means to them a place of gayety, where the water may be drank or let alone, according to one's fancy. I have talked with many people who are in the habit of spending their summers at our watering-places, and they seemed to consider the matter of drinking the mineral waters mostly in the light of a joke. They took them for no special purpose; they had little idea of their effect, but drank the waters mainly because their neighbors did, or because it was fashionable. Using the waters in this aimless, careless manner, is it any wonder that harm is done, and that the efficacy of the waters oftentimes falls into bad repute? Europeans at their spas drink the waters and take the baths as carefully, punctually, and religiously as they say their prayers, and even Americans seem wholly changed when at foreign watering-places, and they would as soon think of selecting any spring, without regard to their ailment, as of drinking the waters which had been selected for them without first consulting the physician of the place as to the proper quantity of water to be taken, and the correct time for drinking it. If Europeans were as much in the habit of visiting our springs as we are of going to theirs, I dare say they would treat our waters with the same marked respect.

It is possible, too, that the value of European mineral waters,

like that of some other things, is enhanced in the minds of Americans because, if not always English, they are foreign. One reason for the difference in the behavior of the American at home and abroad is that he does not appreciate home waters because they can be so easily obtained. Feeble appreciation means little faith, and lack of faith in any remedy is almost always accompanied with little or no benefit, partly from mental causes, and partly because the remedy is not given a fair trial. A voyage across the Atlantic puts an American in condition to be benefited by European waters by improving his general health. I have no idea that Ems or Wiesbaden would have so many American admirers if these springs were situated in Virginia instead of in Germany.

It does not seem worth while to enter deeply into the analyses of the various American mineral waters, nor to determine in what points they are different from those most celebrated in Europe, for I do not believe that this is, at present, the most important part of the subject for American physicians to consider. It is vastly more to the purpose that, whatever mineral spring is used, it should be employed intelligently and on scientific principles, and that the particular spring should be selected by the physician with some regard to the ailment of the patient. The patient should be under strict detailed orders from his physician; and these instructions should cover not only the manner of using the waters, but the matter of food, exercise, social life, mode of living, etc. It is in regard to these points that physicians at the European spas are most particular, and we can learn from them in this respect. Their patients are under good discipline, and understand thoroughly what the treatment is intended to do for them. Carlsbad has not a greater reputation for curing people so much because its waters are better medicinally than the Congress or Hathorn of Saratoga, as because patients at Carlsbad are under better therapeutic conditions; and the same may be said in comparing the waters of Aix-la-Chapelle and of Aix in Savoy with the sulphur waters of Richfield. Trousseau says, in speaking of the waters of Carlsbad and Vichy: "I know of no medication more perilous than that of these waters administered without reserve, without discernment, and without regard to individual conditions of health, etc."

Let us for a moment look for the factors which have tended to make European watering-places so celebrated. Are the "cures" to be credited to the medicinal properties of the waters alone? How much have habits of living at European watering-places to do with

the benefit the patients derive, and what part of the physical improvement is due to a sea voyage, changes in climate and scene, and rest from business? These are pertinent questions in searching for the secret of the success of the celebrated German and French mineral springs.

First, I believe that the *mental effect produced upon a patient by the rigorous course of treatment* which is customary at German springs is very salutary, and is a factor which hitherto has not been sufficiently appreciated at our mineral sanitaria. The physician who loses sight of the value of mental medicine in any kind of practice is working at serious disadvantage, and especially in treating patients who visit mineral springs, for they are, as a rule, a peculiar class. They have traveled much, and have seen everything. They have been treated for their complaints by many physicians in many different ways, and they have long since lost all faith in medicines. They talk over their ills with each other, and are proud to relate how many different "cures" they have tried, and how little benefit they have received. Such a patient can not be cured unless his mental condition can be placed upon a healthy basis. He must be made to feel that his visit at the springs is not mere pastime, but that he has a disease which is understood by his physician, and that the waters are suited to that disease. If they are not, he should be sent to the proper springs. These patients, then, must be taken hold of in a strong manner, for there is no class of patients so unimpressionable as the one to be found at the hotel of a watering-place. They must be made to work for themselves, and in this way they will soon become interested in their recovery, and their thoughts will be upon their cure rather than upon their disease. The whole mode of life at the European spas is one calculated to impress the invalid with the idea that not only is a great deal being done for him, but that he also is doing much for himself to regain his health. There is something in this mental tonic which is very healthful.

During a visit at the French and German springs last summer, I had the pleasure of meeting many of the physicians who practiced there. I was very much impressed with the enthusiasm exhibited by these medical men in regard to their mineral waters. They seemed never tired of talking of them, and they had great faith in their curative properties. A patient quickly sees and feels this quality in a physician, and his own confidence is increased. Among American physicians I have noticed the half-hearted manner in which they

advised the use of mineral springs, when it seemed that the highest praise they could pay the water was that if it was used carefully it would do no harm—"damning it with faint praise."

Another point of difference between European and American spas is in the social life. Life at Richfield and Saratoga is almost a repetition of gay New York during the season. Only a small proportion of the visitors imitate their European cousins in rising early and going to the springs for the waters, but they breakfast at the usual city hour—from eight to ten. Frequently their servants carry the water to their rooms and the invalids drink it in bed. In Europe a person is rarely so feeble that he can not be wrapped up and carried by two attendants in a Sedan chair to the spring and bath, and this is done rain or shine. I was at Aix-les-Bains one day when the rain was falling in torrents, but this did not diminish the number of people at the bath-house. The feeble patients were wrapped up head and foot in rubber blankets and carried from their hotels to the spring. One sees little of this in America. It certainly would not become popular at our leading mineral spas unless it was fashionable, and it would not readily become fashionable unless the better classes of people had the sole monopoly. The ladies who, as they themselves express it, are "literally worn out" by the season's work, and who have come to the sanitarium to regain their health and to rest, do not in the slightest degree relax their interest in society matters and dress. And the lines separating the various "sets" are as rigidly drawn in the country as in town. It is unfortunate that this should be the grade of life at our mineral springs, and that our mineral waters should be expected to cure not only gout and bronchitis, but the vices of living which occasion these diseases. The same change is needed as in a patient whom Trousseau and Pidoux thus describe: "Living in the midst of luxury, not getting up till midday, confining herself most of the afternoon to a perfumed room which the light scarcely penetrates, taking a drive in a close carriage when the weather is fine enough, living on made dishes which are made the more piquant as her appetite grows more fantastic. Next she is influenced by her passions, good or bad, sad or gay, her social and family duties—the routine of every-day little annoyances, and finally by ennui, that pest of idleness and of riches. Her appetite fails, her digestion is languid, her nervous system is exalted. She gives an endless deal of trouble to her doctor, who can do little for her and who in despair sends her to some spa. There her habits are changed in every way. She has to get up early in the morning for her water or her bath. She leads

a comparatively simple life in the open air—and, without going into further details as to her changed mode of life, can you wonder if she returns to Paris cured?"

I was impressed with the simplicity of life and habit at Carlsbad. Among the hundreds of people who were waiting in line to reach the famous Sprudel, almost every nationality under the sun was represented, as could be seen by their different styles of dress. People, too, in every station of life were there, from the nobleman to the poor Pole. Side by side they drank the waters with apparently but one desire—to regain their health. They were enthusiasts. They observed to the minutest detail the instructions of their physician both as to the temperature and the amount of water they drank. Many of them were out of bed at four o'clock in the morning, in order to get the water before the great rush began; and, from conversation, I learned that some of these people retired as early as eight in the evening to get sufficient sleep before the early start. It was a little ridiculous to hear patients exalt the virtues of the spring they were assigned to, and speak disparagingly of the others, when it is remembered that the waters of Carlsbad differ from one another but slightly except as to the temperature. The greatest man in Carlsbad is the veteran of many seasons who can drink without discomfort large quantities of the waters. He is envied by all the men and women who are limited by their physicians to a single glassful. It was very evident that these people had come to Carlsbad from all parts of the world for the *waters* and for nothing else. Patients there breakfast simply on coffee and rolls, and each patient goes to a bakery, buys his bread, and carries it to a coffee-house, where he eats it. I speak of these simple details because they present such a striking contrast to the mode of life at our watering-places. At Saratoga I heard a woman say, when she was asked if she did not fear that the bountiful breakfast she was eating would counteract the desired effects of the mineral waters she had taken an hour before, that "it was hard enough to get out of bed at seven in the morning and drink the waters, and she did not propose to starve herself." She was a stout woman and had been sent by her physician to drink the waters for rheumatism and gout. Under such circumstances, is it a matter of much importance whether the waters contain a little more or a little less lithium, or whether the cathartic principle is Epsom or Glauber's salts? Physicians and hotel-keepers at mineral springs, who lay great stress upon the presence of a fraction of a grain of some valuable medicinal salt in their pet mineral water, are not looking at

the question in all its different phases. We all know that there is a great deal of truth in the statement of Dr. Beale, an English writer. He says: "If patients could be induced to retire to a pleasant part of the country, where they would take moderate exercise and be free from mental anxiety, meet with agreeable society, live regularly, take small doses of alkalies, and bathe themselves for an hour or two a day in warm water in which some carbonate of sodium has been dissolved, they would receive as great benefit as by traveling hundreds of miles away and at much less trouble and expense." But, after all, such a happy combination of circumstances and conditions can not be readily found in our country, and certainly not nearer to New York than our watering-places, where all the desirable factors recommended by Dr. Beale can be at the disposal of patients, if their physicians in town and in the country will not content themselves with simply telling them how to use the water, but will also give careful instructions about eating, exercise, and habits of life generally. The amount of benefit the patient obtains and the reputation of the spring will largely depend upon these commonplace matters of living. While I found that almost all of the physicians I met at the different watering-places throughout Belgium, Switzerland, Germany, and France were fully convinced that their own spring was competent to cure every patient whose ailment came in their particular line, I also noted that these physicians did not have faith enough to believe that their waters could cure a gouty man who continued to drink wine at late dinners or reduce the weight of a woman who sat in her hotel-room all day. They order their patients to walk a great deal, and, as many of the European spas are situated at the foot of mountains, the walks are up and down steep inclines. The physicians did not lay much stress upon these outside matters of eating and exercise, and were disposed to give to the waters the entire credit of the cure. But they were giving their mineral waters a fair trial by placing their patients in the best hygienic conditions. Patients, too, were educated to believe that the *waters* were the sheet-anchor upon which they were to depend. They walked many miles to digest the waters and make room for more. They ate only the simplest varieties of food, because all luxuries were incompatible with the chemical action of the salts, which were to revolutionize their disordered bodies, and they went to bed early only for the sake of being able to drink the waters at the most appropriate time—at day-break. Is it any wonder that the majority of patients who visit these springs and who have led the sedentary lives common to the inhabitants of cities improve on such

a regimen and return to the same watering-place whenever they are out of health, believing that it is the only spot on earth for them? We were almost going to say that their improvement under these conditions would be as pronounced if there was nothing but Croton water to drink and bathe in, but this would not be true, for many of the European waters are wonderful.

The social life I have spoken of, which is common to our watering-places, *shuts out the real invalid*, who must be away from noise and gay, active life; and many of these people go to Europe.

While I believe that the majority of visitors at European spas are to some extent invalids, Dr. George E. Walton says, in his excellent book on "The Mineral Springs of the United States," that "many, and in this country perhaps the majority, of visitors at springs journey thither not because of any specific malady with which they are afflicted, but to obtain relief and rest from the harassing care of business." It has come to be believed that, while our springs are good for healthy people, they have not sufficient virtue to cope with organic diseases. This feeling has come about, not from a lack of waters in the United States whose analyses show them to be equal to those abroad, but because of the inefficient manner in which they have been employed. It will readily be seen that the comparison between our waters and those of the Old World can never be a fair one to us until we follow the example of our profession across the water and place our patients under all the conditions most favorable to health.

Another feature, which up to this time has been wanting, and which our mineral springs sorely need to give them reputation and efficiency, is the *indorsement of the medical profession.* And I do not mean subscribing to the advertisement of any company who are bottling the waters of some spring, but physicians, individually or in committees appointed for the purpose, should have careful analyses made, and they should ascertain by clinical investigation the therapeutical value of our mineral waters, and, if they are found to be valuable medicinal agents, they should be given a place as such in our materia medicas. This is another advantage that the European springs have had. Mineral-water treatment forms quite a large portion of the therapeutics recommended by von Niemeyer* in his "Text-book of Medicine," and he speaks in no doubtful manner, as, for example: "In our present state of knowledge, a course of water

* Von Niemeyer, "Text-book of Medicine," vol. ii, p. 781.

at Carlsbad is the measure which should deserve the chief reliance as a remedy for diabetes mellitus." In the treatment of renal calculus Sir Henry Thompson * says: "Of all medicinal remedies, perhaps none are so valuable as mineral waters," and Trousseau and Murchison speak in the same emphatic terms in respect to the treatment of other diseases.

Not only have the medical profession of Europe made the therapeutics of mineral waters popular by their indorsement, but the German and French governments have largely supported their springs. In Germany a majority of the springs belong to the Government, which appoints general and local inspectors, whose duty it is to regulate all matters connected with them. The price for the use of the water and baths is fixed by the Minister of Commerce. In some instances the bath physicians hold official positions under the Government. It is usual to arrange the tariff in three classes, in order to bring the price within the reach of the poor and rich alike. Austria supports baths for the use of her invalid soldiers. By means of this governmental support large luxurious bath-houses, furnished with all necessary and sometimes most elaborate apparatus, are kept open for the public. In America the improvement of mineral springs, erection of bath-houses, purchase of apparatus, etc., have been effected entirely by private capital; and the want of money has frequently been the main obstacle in developing our mineral resources.

At Aix-les-Bains, in Savoy, there are four large swimming baths with douches of various kinds and about fifty rooms, each having two attendants, who administer what is there called the "grande douche." The patient sits on a low wooden stool with his feet in warm mineral water; one attendant, standing behind, deluges the back with the water, which pours out of a large hose, while the second attendant washes and rubs the front of the body. Dr. Grainger Stewart, of Edinburgh, who took a course of baths at Aix-les-Bains, says: "It is astonishing with what skill, patience, tenderness, and firmness the shampooing and passive movements are performed." Dr. Brachet, of Aix-les-Bains, told me that the large increase in the number of bathers—from eleven thousand in 1872 to twenty-four thousand in 1882—was, in his opinion, due as much to the skill of the two hundred employees as to the therapeutic reputation of the waters. These attendants bring their patients in Sedan chairs from their hotels, and, after the bath and massage, they carry them back

* Thompson, "On the Urinary Organs," 1869, p. 202.

and put them to bed, rubbing them until the normal temperature is restored. I might speak of the many varieties of douches at Ems, some of which are to be found in our Russian bath-houses—of the inhaling-rooms, filled with finely pulverized mineral waters; of the departments devoted to the spraying of the waters for the relief of nasal and bronchial catarrh; of the carbonic-acid-gas baths; of the various appliances for directing mineralized steam upon a single rheumatic or gouty joint; of the mud and peat baths to be found at Carlsbad, and the amphitheatre at Royat in France, where numerous patients sit about a large opening which looks like the funnel of an ocean steamship, and inhale the mineralized steam which pours out of it. The interesting method of douching at Royat deserves a word. The attendant in charge stands on a raised platform about six feet from the patient. Within easy reach there are a number of faucets which regulate the temperature of the water and the force and size of the stream. With a hose and nozzle the attendant can direct any kind of a stream upon the patient, from fine needles to a large douche, and at any temperature. This is used so skillfully that a patient's temperature can be nicely regulated after he has taken his bath and before he goes home. There are many more styles of treatment, but you are all familiar with them. It is not my purpose to describe any methods of medication, nor to endeavor to ascertain the amount of benefit that patients derive from them. That great benefit is obtained is not to be doubted, and it is equally true that the reputation of the leading European mineral waters is increasing every year. I have been interested in searching for the causes that have contributed to this success, because I believe that if they can be ascertained they can be employed with advantage by us at home. We have the waters, and, if this subject of mineral-water therapeutics is an important one, then what has been said in this paper is not inappropriate for the consideration of this association.

Last year, at New York, your president, Dr. A. L. Loomis, spoke of the necessity of making further investigation and obtaining greater knowledge of mineral-water therapeutics, and more attention is being paid to this subject by the medical profession. At Richfield Springs, I learn that between two and three hundred mineral baths are given daily during the season, that new springs have been developed during the last six months, and that they have sufficient water now to give one thousand baths daily. Two years ago a department for the atomization of sulphur water for the treatment of catarrh of the upper air-passages was also arranged at Richfield, a room where the water

was sprayed by steam, and stalls where it was atomized by compressed air. There is a similar department connected with the sulphur baths at Sharon.

Before closing, I wish to express my obligation to Dr. Brachet, of Aix-les-Bains, Dr. Brand, of Royat, Dr. Schnee, of Carlsbad, and Dr. Reuter, of Ems, for courtesies and valuable information extended to me. Allow me to repeat the suggestions offered in this paper, which, if followed, I believe will increase the therapeutical value of our mineral springs:

1. Physicians, individually or in committee, should make careful analyses of our mineral waters.

2. The medicinal value of the waters should be tested by clinical investigation, and the conclusions arrived at given to the profession.

3. If the waters are found to possess marked medicinal merit, physicians should interest themselves in the development of the springs and the improvement of bath-houses and apparatus.

4. Physicians, in sending patients to a mineral spring, should be most careful to select the proper water, and should send with the patient his history and the diagnosis of his disease for the benefit of the physician at the bath.

5. Patients at our mineral spas should be placed under more rigid medical discipline, and more attention should be paid to their habits of living.

6. The social life at our watering-places should be placed on a more wholesome basis.

Paper.

AIKEN AND THOMASVILLE AS TYPES OF THE INLAND HEALTH-RESORTS OF SOUTH CAROLINA AND GEORGIA.

By W. H. GEDDINGS, M. D.

DURING the winter of 1885–'86 I was requested by a committee of the American Climatological Association to prepare a paper on the inland health-resorts of South Carolina and Georgia, to be read at the annual meeting in May. On investigating the matter, I found that Aiken and Thomasville were the only places for which I could obtain the requisite meteorological data. This, and the fact that the other localities considered to be health-resorts were comparatively unimportant, induced me to devote my whole attention to the above-mentioned resorts, one of which has been known

to the profession for over thirty years, while the other has sprung into existence as a health-resort only within the past six or eight years. As regards temperature, there is but little difference between the resorts in the interior of the South Atlantic States and those on the coast, the interior being about two degrees colder. Thus, the mean annual temperature on the coast of South Carolina and Georgia is 67°, while that of the inland stations is 65°. But with this similarity of temperature all resemblance ceases, the coast, as one would naturally expect, being moist and sedative, while the interior is more or less dry and bracing. Hence the former is indicated in bronchitis when the cough is dry and tight and attended with little or no expectoration, and in all diseases where there is great irritability of the nervous system. The interior resorts, on the other hand, are better suited for the treatment of diseases of an asthenic type, and are especially beneficial in pulmonary phthisis; but to all of this I shall again refer in another portion of this paper.

Topography, etc.—Aiken is located on the southern border of what is known as the Sand-Hill region. It is about 565 feet above sea-level, and is the highest point within a radius of a hundred miles. It is 120 miles west of Charleston and 17 east of Augusta. Thomasville is about 100 miles farther south, a little north of the Florida line, in what is designated on the agricultural maps of the "Tenth United States Census" as the region of the long-leaf pines. Its altitude is 330 feet, and is therefore 235 feet lower than Aiken, but, like the latter place, it is much higher than the surrounding country. It is about 150 miles from the Atlantic Ocean and 60 miles north of the Gulf of Mexico.

The Sand-Hill region in which Aiken is situated is a tract of sandy soil of moderate elevation and about twenty miles in breadth, extending through the middle portions of South Carolina and Georgia. Commencing in Chesterfield County in the northern border of the former State, it extends in a southwesterly direction until it reaches the Savannah River at Augusta. Reappearing on the other side of that river, it crosses the State of Georgia in the form of a narrow strip which terminates on the western border of the State. Consisting, as its name implies, chiefly of fine loose sand, this region in its natural state is so utterly worthless for agricultural purposes that it well deserves to be called the "pine barrens," the name applied to it by many of the natives. But, although naturally so unproductive, the soil of this region contains a certain proportion of clay which makes it very retentive, so that, by the addition of fertilizers, it may

be made to produce valuable crops of cotton and other products. The subsoil of this region is very porous, and water is rarely found at a depth of less than 80 feet, and often it is necessary to dig 150 feet before it is reached. Owing to the porosity of the soil, water disappears rapidly from the surface, so that even the heaviest rains interfere but little with the out-door life of the invalid.

The inhabitants of Charleston and the planters of the counties along the coast were long ago familiar with the extreme salubrity of this favored region, and, as soon as the South Carolina Railroad was completed, hastened to avail themselves of Aiken, not only as a sanitarium for consumptives, but also as a place of refuge from the deadly malaria (bilious remittent or country fever) which rendered their estates uninhabitable during the warmer months of the year. As a proof of the healthfulness of the Sand-Hill region, it is stated in the "United States Census for 1880"* that at Platt Springs, a little hamlet in the adjoining county of Lexington, there were in 1879 but two deaths out of a population of 853, and in 1880 only four, and that of these, three of the decedents were over eighty years of age. The sandy soil of this section, as well as that around Thomasville, is covered with forests of the long-leafed pine (*Pinus australis*) and black-jack oak. The former is remarkable for the large amount of resin it contains, and it is the "light-wood" of this tree which affords the bright, cheerful fires which are so attractive to the Northern invalid. Whether these trees, by generating ozone or peroxide of hydrogen, really add to the purity of the atmosphere, is still an open question, but it is quite certain that the terebinthinate exhalations from the pine forests around Aiken and Thomasville are exceedingly grateful to pulmonary invalids. Although we may not be able to offer any satisfactory explanation of their physiological action, there can be no doubt that the presence of large tracts of pine forests add materially to the therapeutic value of a health-resort. In common with all forests, they afford protection against the wind, but in addition to this, for some hitherto unexplained reason, the air of the pine woods is apparently warmer than that of forests of oak and other trees. This is so marked that, on driving through the country on a cold winter day, the entrance into even a comparatively small thicket of pines gives rise to a sensation of warmth similar to that which is experienced on going from the cold outside air into a comfortably heated apartment. Hermann Weber

* "Tenth Census of the United States," vol. vi, p. 90.

states* that he has often known tender exotics growing in a forest of firs to remain uninjured by the severe cold of winter when those in more open situations in the same neighborhood were destroyed.

A wooded country is much more equable than an open plain, a fact which applies to humidity as well as to temperature. Absence of dust, with its injurious effects upon the mucous membrane of the respiratory tract, is another advantage which the presence of pine forests confers upon a health-resort. Eliot and Storer remark in their work on organic chemistry that "the disinfecting power of ozone produced by the action of the atmosphere on turpentine is interesting in connection with the observed facts, that ozone is abundant in the air of pine forests where turpentine abounds, and that pine forests are remarkably free from malaria." This protection against malaria afforded by pine forests has long been known to the rice planters of the coast of Georgia and South Carolina, who, during the summer, as night approaches, retire to their pine-land settlements, and find there a safe refuge from the deadly poison which pollutes the air of the surrounding country and makes it extremely dangerous for a white man to remain there after nightfall.

Some twenty miles from Charleston is the pine-land village Summerville, which, although located in the midst of the malarial belt, is so healthy that hundreds of families from the city utilize it as a summer resort, and so great is the faith of the inhabitants in the immunity afforded by pines that a heavy fine is imposed for cutting down one of these trees without the permission of the Municipal Council. From the above we arrive at the following conclusions in regard to the influence of pine forests upon the climate of a locality —viz.: That they render the temperature and humidity more equable; that they afford protection against high winds; that in winter they are warmer than the open country; that by generating ozone or peroxide of hydrogen they disinfect the air; and that to some extent their terebinthinate exhalations moderate the amount of secretion from the mucous membranes of the air-passages, and thus exercise a curative influence in bronchial catarrh.

I have dwelt at some length on the subject of pine forests, as I believe that their presence adds materially to the usefulness and attractiveness of a health-resort in this section of the country. They are said to be much more extensive at Thomasville than at Aiken, where, owing to the great demand for land for agricultural

* H. Weber, "Klimatotherapie." Ziemssen, "Allgemeine Therapie," Leipzig, 1880, p. 62.

purposes and to the absence of all laws for their protection, they have been every year most recklessly destroyed. They are, however, still quite numerous, and steps are being taken to prevent their wanton destruction and to encourage the planting of new trees.

Meteorology.—As the limits of this paper preclude any detailed discussion of the various elements which, when taken together, constitute climate, I have prepared a series of tables, by referring to which the reader can compare at a glance the climate of Aiken with that of Thomasville, and thus be enabled to form his own opinion in regard to the merits of the two resorts, and determine which of the two places is best adapted for the class of cases he may conclude to subject to climatic treatment. With this view I have compiled two tables for each of the more important meteorological factors, such as temperature, humidity, etc., the first giving a general summary of a series of observations extending over a number of years, and the other a record of tri-daily observations made during March and April, 1886, at both places and at the same hours. For the later observations at Thomasville I am indebted to Dr. W. R. Birdsall, of New York, and Dr. W. S. Little, of Philadelphia. These gentlemen were prepared with a book of instructions issued by the U. S. Signal Service and a set of instruments from the same bureau, the latter being in every respect similar to those used at Aiken. These observations were taken with the most scrupulous care, and, although covering only a limited period, are of inestimable value.

Much to my regret, the Thomasville observations extend over only four years, while those of Aiken cover a period of eleven years. I applied to Dr. T. S. Hopkins for the more recent observations, but was refused on the ground that the unpublished meteorological data were the property of Dr. Huntington Richards, one of the collaborators of Wood's "Reference Hand-book of the Medical Sciences." So far as temperature is concerned, the absence of the two additional years is a matter of but little importance, the difference between those given above and the more extended series amounting to but one degree. For those given I am indebted to Dr. Hopkins's pamphlet, "Thomasville as a Winter Home for Invalids."

The following table gives the mean temperature of Aiken and Thomasville during the six colder months, and the mean temperature of the months and seasons.

On examining the table, it will be seen that the mean temperature of the six colder months is about five degrees colder at Aiken

than at Thomasville, the difference in winter being five and in spring four degrees.

TABLE No. 1.

Comparing the mean temperature of Aiken with that of Thomasville. Period of observation at Aiken, eleven years; period of observation at Thomasville, four years.

	Aiken.	Thomasville.	Aiken colder than Thomasville.
	Degrees.	Degrees.	Degrees.
November	54	59	5
December	47	53	6
January	48	54	6
February	50	56	6
March	56	62	6
April	66	67	1
Six colder months	53	58	5
Winter	50	55	5
Spring	57	61	4

TABLE No. 2.

The mean temperature of Aiken at 7 a. m., 2 p. m., and 9 p. m., with the average daily range from 1873 to 1884.

	7 A. M.	2 P. M.	9 P. M.	Range.*
	Degrees.	Degrees.	Degrees.	Degrees.
November	49	61	53	12
December	42	54	47	12
January	42	54	48	12
February	43	57	50	14
March	49	64	56	15
April	57	71	63	14
Six colder months	47	60	53	13
Winter	44	56	49	12
Spring	49	64	56	15

The observations at 7 A. M., 2 P. M., and 9 P. M., although not as accurate as the readings of the maximum and minimum thermometers, afford a fair idea of the highest and lowest temperature of the different months, and are of more importance in forming an estimate of the extremes of temperature to which the invalid is subjected. It would be obviously unfair to estimate the average winter at Thomasville and Aiken by the low temperature which prevailed during the early days of January of the present year, which, judging

* The difference between the lowest and highest tri-daily means.

from its effects upon vegetation, is considered the coldest ever experienced during the last two hundred years.* The average range of temperature, as given in the third column, is very moderate for a dry climate like that of Aiken.

The following table requires no comment, but is exceedingly useful as a supplement to Tables Nos. 1 and 2. It shows that the means of the month of February, 1886, at both places correspond with the average given in Table No. 1. During the ensuing month (March) the temperature was seven tenths of a degree lower at Aiken, and three and a half degrees lower at Thomasville. During the two months Aiken was, on the average, only three degrees colder than Thomasville. The average range during February was thirteen de-

TABLE No. 3.

Temperature observed at Aiken and Thomasville from February 8 to March 31, 1886, at 7 a. m., 2 p. m., and 9 p. m.

1886.	7 A. M.		2 P. M.		9 P. M.		MEANS. $\frac{1}{4}(7+2+9+9)$		Difference between Aiken and Thomasville.
	Aiken.	Thomasville.	Aiken.	Thomasville.	Aiken.	Thomasville.	Aiken.	Thomasville.	
	Deg.	Deg.	Deg	Deg.	Deg	Deg	Deg.	Deg.	Deg.
Feb. 8	42	48	61	66	53	51	52·2	54·0	Aiken 1·8 colder.
" 9	43	45	63	63	58	53	55·5	53·5	" 2·0 w'rmer
" 10	55	58	68	72	62	62	61·7	63·5	" 1·8 colder.
" 11	51	55	54	74	53	62	52·7	63·2	" 10·5 "
" 12	52	57	56	61	46	48	50·0	53·5	" 3·5 "
" 13	36	40	52	60	44	48	44·0	49·0	" 5·0 "
" 14	47	48	63	70	58	57	56·5	58·0	" 1·5 "
" 15	50	56	68	73	51	60	55·0	62·2	" 7·2 "
" 16	32	42	48	60	42	46	41·7	48·5	" 6·8 "
" 17	34	41	46	59	40	48	40·0	49·0	" 9·0 "
" 18	38	46	54	50	42	50	44·0	49·0	" 5·0 "
" 19	45	52	58	70	52	56	51·7	58·5	" 7·2 "
" 20	31	45	40	52	35	38	35·2	43·2	" 8·0 "
" 21	27	31	52	60	48	53	43·7	49·2	" 5·5 "
" 22	42	52	62	70	53	54	52·5	57·5	" 5·0 "
" 23	48	49	66	72	59	54	58·0	57·2	" 0·8 w'rmer
" 24	45	53	64	73	58	58	58·7	60·5	" 1·8 colder.
" 25	60	62	62	70	57	63	56·5	64·5	" 8·0 "
" 26	40	51	53	59	45	50	44·2	52·5	" 8·3 "
" 27	35	47	45	50	35	50	38·7	49·2	" 10·5 "
" 28	33	45	36	49	37	47	35·7	47·0	" 11·3 "
Mean of 28 days.	42·1	48·7	55·6	63·4	48·5	52·8	48·9	54·4	Aiken 5·4 colder.

* The cold at the time referred to was so intense that it killed palm-trees which had been growing on Sullivan's Island, near Charleston, for upward of two hundred years.

TABLE No. 3.—(*Continued.*)

1886.	7 A. M.		2 P. M.		9 P. M.		MEANS 7+2+9+9 / 4		Difference between Aiken and Thomasville.
	Aiken.	Thomasville.	Aiken.	Thomasville.	Aiken.	Thomasville.	Aiken.	Thomasville.	
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
March 1	36	46	59	57	49	54	48·2	52·7	Aiken 4·5 colder.
" 2	38	51	55	61	51	60	48·7	58·0	" 9·3 "
" 3	37	44	52	57	48	60	46·2	55·2	" 9·0 "
" 4	39	48	48	48	44	46	43·7	47·0	" 3·3 "
" 5	41	48	60	55	54	53	52·2	52·2	" 0·0 "
" 6	46	52	60	66	54	58	55·5	56·0	" 2·5 "
" 7	41	48	54	55	47	50	47·2	50·7	" 3·5 "
" 8	47	56	63	64	49	56	52·0	58·0	" 6·0 "
" 9	45	54	57	60	46	56	48·5	56·5	" 8·0 "
" 10	37	45	42	48	38	40	38·5	43·2	" 4·7 "
" 11	37	35	49	59	45	50	51·5	48·5	" 3·0 w'rmer
" 12	45	51	57	60	55	62	53·0	58·7	" 5·7 colder.
" 13	51	55	54	47	48	45	50·2	48·0	" 2·2 w'rmer
" 14	41	40	63	60	59	52	55·5	51·0	" 4·5 "
" 15	46	50	67	73	60	61	58·2	61·2	" 3·0 colder.
" 16	57	61	65	64	57	61	59·0	61·7	" 2·7 "
" 17	52	62	69	72	64	68	62·2	67·5	" 5·3 "
" 18	52	65	68	72	64	63	62·0	65·7	" 3·7 "
" 19	60	62	73	70	67	68	66·7	67·0	" 0·3 "
" 20	66	69	68	70	64	68	65·5	68·7	" 3·2 "
" 21	52	56	64	67	53	55	55·5	58·2	" 2·7 "
" 22	48	51	59	63	53	54	53·2	55·5	" 2·3 "
" 23	46	54	56	68	49	54	50·0	57·5	" 7·5 "
" 24	43	52	64	69	58	57	55·7	58·7	" 3·0 "
" 25	55	56	75	73	64	60	64·5	62·2	" 2·3 w'rmer
" 26	60	59	75	74	67	60	67·2	63·2	" 4·0 "
" 27	60	64	72	70	67	66	66·5	66·5	" 0·0 "
" 28	64	65	68	71	61	68	63·5	68·0	" 4·5 colder.
" 29	47	66	49	75	52	70	50·0	70·2	" 20·2 "
" 30	65	74	80	78	72	69	72·2	72·5	" 0·3 "
" 31	58	58	61	61	48	48	53·7	53·7	" 0·0 "
Mean of 31 days.	48·8	54·7	63·1	64·1	55·7	57·8	55·3	58·5	Aiken 3·2 colder.

The Thomasville observations from February 8 to March 7 were made by Dr. W. R. Birdsall, of New York, and from that date to March 31 by Dr. W. S. Little, of Philadelphia.

grees and five tenths at Aiken and fourteen degrees and seven tenths at Thomasville. During March it was fourteen degrees and three tenths at Aiken, and nine degrees and four tenths at Thomasville. To enable the reader to compare the temperature of Aiken and Thomasville with that of other places I have compiled the following tables, giving the mean temperature during the six colder months at some of our principal cities, and at the most generally known health-resorts in this country and abroad:

TABLE No. 4.

Comparing the mean temperature of Aiken with Thomasville during the six colder months (November to April, inclusive) with that of some of the larger cities of the United States.

	Deg.									
Aiken	53									
Thomasville	59	Deg.					Deg.			
Boston	33	20	colder	than	Aiken	and	26	colder	than	Thomasville
New York	36	17	"	"	"	"	23	"	"	"
Chicago	34	19	"	"	"	"	25	"	"	"
Cincinnati	34	19	"	"	"	"	25	"	"	"
Baltimore	41	12	"	"	"	"	18	"	"	"
Jacksonville	61	8	w'rmer	"	"	"	2	warmer	"	"

TABLE No. 5.

Comparing the mean temperature of Aiken and Thomasville during the six colder months (November to April, inclusive) with that of several well-known health-resorts.

	Deg.									
Aiken	53									
Thomasville	59	Deg.					Deg.			
Davos	−30	83	colder	than	Aiken,		89	colder	than	Thomasville
Colorado Sp'gs	32	21	"	"	"		27	"	"	"
Denver	36	17	"	"	"		23	"	"	"
Pau	45	14	"	"	"		20	"	"	"
Meran	44	9	"	"	"		15	"	"	"
Ashville	43	8	"	"	"		14	"	"	"
Mentone	55	2	warmer	"	"		4	"	"	"
Catania	56	3	"	"	"		3	"	"	"
Cannes	56	3	"	"	"		3	"	"	"
Santa Barbara	57	4	"	"	"		2	"	"	"
Nice	57	4	"	"	"		2	"	"	"
Algiers	59	6	"	"	"		0	"	"	"
Cairo	63	10	"	"	"		4	warmer	"	"
St. Augustine	63	10	"	"	"		4	"	"	"
Madeira	72	19	"	"	"		13	"	"	"

Humidity.—In forming an estimate of the climate of a health-resort, the humidity of the atmosphere ranks next in importance to its temperature. Judged by popular signs—such as the rare occurrence of heavy dews, infrequency of fogs, absence of condensation of moisture on the walls of houses, the rarity of rust on guns and steel instruments, and of mold on boots and shoes—both Thomasville and Aiken would be regarded as exceptionally dry. At Aiken this is further proved by the absence of the gray tree-moss (*Tillandsia*), which abounds in the Atlantic States wherever there is sufficient moisture to promote its growth.* The presence of this moss is not

* Whether this moss grows at Thomasville I am unable to say, and at the moment of writing have no means of ascertaining the fact.

only a sign of moisture, but is popularly regarded as a test of the healthfulness of a locality, and it is a well-known fact that it abounds in those sections where bilious remittent fever is most prevalent.

Scientifically, the amount of aqueous vapor in the atmosphere is expressed by its absolute and relative humidity. The former is synonymous with the tension of vapor, or, more intelligibly, by the weight of water in a given quantity of air. This method of designating the humidity is seldom employed in works on medical climatology. The term relative humidity, expressing as it does the percentage of saturation, is much more satisfactory. The amount of water that the atmosphere is capable of containing in the form of vapor varies with its temperature. When it has all the vapor it is capable of holding it is said to be saturated, and this condition of saturation is expressed as 100 per cent.—that is, its relative humidity is 100 per cent. If it has only one half its complement of water, its relative humidity is said to be 50 per cent., and so on from 1 to 100 per cent. The amount of aqueous vapor that the atmosphere is capable of holding varies with its temperature, being greater when the air is warm, greater in summer than in winter, and greater in a warm than a cold climate. The relative humidity exercises a powerful influence upon animal and vegetable life. It is a well-known fact that the inhabitants of a dry climate are, as a rule, thin and sallow, while those living in a moist insular country have well-developed figures and fresh, ruddy complexions. It is to the greater dryness of this country that we owe the peculiar physique of our people, which is so different from that of our English ancestors.

Schlagintweit, a German, who traveled extensively in this country, notes this peculiarity, asserting that we are very proud of the leanness of our women: "According to Pettenkofer and Voit, the human body exhales from the lungs and skin twenty-eight ounces in twenty-four hours, and of this a little over seventeen ounces is from the skin alone, and, as the amount exhaled depends in a great measure upon the hygrometric condition of the atmosphere, it becomes apparent that even a slight change of only one per cent. in the relative humidity exercises a marked influence upon the cutaneous exhalations, and any diminution in the cutaneous and respiratory exhalations produces a corresponding increase in the urinary secretions, and not infrequently in that of the intestinal canal." "Dry climates, by diminishing the water in the blood, act as a powerful stimulant to the nervous system, increasing its functional

activity, causing excitement and sleeplessness." Hence such climates, although admirably adapted to the treatment of pulmonary diseases, are contra-indicated in many nervous affections. "This effect is observed even in healthy persons on their removal to a dry climate, or to one of considerable elevation, and exhibits itself in a certain degree of restlessness." Sudden changes in the percentage of relative humidity operate very sensitively in a diseased organism, their first effects being a sudden increase or diminution in the blood-pressure. Hence high altitudes, owing to diminished atmospheric pressure, even when combined with a high percentage of relative humidity, is similar in its effects to a dry climate with lower elevation.*

TABLE No. 6.

Monthly mean relative humidity at Aiken for seven seasons, and at Thomasville for four seasons.

	Aiken.	Thomasville.	Aiken drier than Thomasville.		Aiken.	Thomasville.	Aiken drier than Thomasville.
	Per ct.	Per ct.	Per ct.		Per ct.	Per ct.	Per ct.
January.....	62·20	65·00	2·80	November.....	61·70	67·00	5·30
February.....	56·10	62·00	4·90	December.....	58·80	64·00	5·20
March.....	52·10	61·00	8·90				
April.....	56·20	60·00	3·80	Mean.....	57·85	63·16	5·15

According to the condensed observations in Table No. 6, the mean relative humidity of the season is 57·85 percent. at Aiken and 63·16 per cent. at Thomasville, a difference of a little over 5 per cent. in favor of the former place. The winter mean at Thomasville is 65·33 per cent., while that of Aiken is 60·90 per cent., a difference of 4·43 per cent. In the spring the relative humidity is 61·00 per cent. at Thomasville and 54·80 per cent. at Aiken, a difference of 6·20 per cent. in favor of the latter place. The detailed observations taken by Dr. Birdsall and Dr. Little during the months of February and March give Thomasville a much larger percentage of humidity than that recorded in Table No. 6, while the Aiken observations for the same period exhibit a variation of only one half per cent. from the annual mean. According to these observations, the relative humidity for the months of February and March was 73·09 per cent. at Thomasville and 53·56 per cent. at Aiken, a difference of nearly 20 per cent. It should be remembered, however,

* Hann, "Klimatologie," Stuttgart, 1883, p. 35.

TABLE NO. 7.

Tri-daily observations of relative humidity at Aiken and Thomasville, from February 8 to March 31, 1886. The latter by Dr. W. R. Birdsall, of New York, and Dr. W. S. Little, of Philadelphia.

1886.	Aiken, 7 A. M.	Thomasville, 7 A. M.	Difference between Thomasville and Aiken.	Aiken, 2 P. M.	Thomasville, 2 P. M.	Difference between Thomasville and Aiken.	Aiken, 9 P. M.	Thomasville, 9 P. M.	Difference between Thomasville and Aiken.	Aiken, mean.	Thomasville, mean.	Difference between Thomasville and Aiken.
FEBRUARY.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
8.....	65	96	Aiken 31 drier.	50	45	Aiken 5 moister.	66	80	Aiken 14 drier.	60·3	73·6	Aiken 13·3 drier.
9.....	67	83	" 16 "	41	56	" 15 drier.	47	72	" 25 "	51·6	70·3	" 18·7 "
10.....	44	86	" 42 "	36	53	" 17 "	56	72	" 16 "	45·3	70·3	" 25·0 "
11.....	86	93	" 7 "	86	64	" 22 moister.	93	87	" 6 moister.	88·0	81·3	" 6·7 m'ster
12.....	86	86	" 0 "	80	56	" 14 "	68	71	" 3 drier.	78·0	71·0	" 7·0 "
13.....	61	82	" 19 "	11	44	" 33 drier.	45	86	" 41 "	39·0	70·6	" 31·6 drier.
14.....	77	93	" 16 "	63	53	" 10 moister.	17	93	" 76 "	52·3	79·6	" 27·3 "
15.....	77	86	" 9 "	47	55	" 8 drier.	66	60	" 6 moister.	63·3	67·0	" 3·7 "
16.....	53	65	" 12 "	12	39	" 27 "	26	68	" 42 drier.	30·3	57·3	" 27·0 "
17.....	43	64	" 21 "	27	42	" 15 "	30	56	" 26 "	33·3	54·0	" 10·7 "
18.....	46	53	" 7 "	34	71	" 37 "	43	77	" 34 "	41·0	67·0	" 26·0 "
19.....	60	86	" 26 "	40	39	" 1 moister.	40	57	" 17 "	46·6	60·6	" 14·0 "
20.....	29	31	" 2 "	21	16	" 5 "	44	61	" 17 "	31·3	36·0	" 4·7 "
21.....	41	88	" 47 "	16	44	" 28 drier.	27	55	" 28 "	28·0	62·3	" 34·3 "
22.....	50	66	" 16 "	42	36	" 6 moister.	40	62	" 22 "	44·0	54·6	" 10·6 "
23.....	42	77	" 25 "	22	37	" 15 drier.	34	80	" 46 "	32·6	64·6	" 32·0 "
24.....	45	66	" 21 "	30	27	" 3 moister.	58	74	" 16 "	44·3	55·6	" 11·3 "
25.....	75	84	" 9 "	73	70	" 3 "	86	90	" 4 "	78·0	81·3	" 3·3 "
26.....	57	47	" 10 moister.	19	30	" 11 drier.	31	58	" 27 "	35·6	45·0	" 9·4 "
27.....	44	56	" 12 drier.	25	86	" 61 "	69	93	" 24 "	46·0	78·3	" 32·3 "
28.....	88	93	" 5 "	89	86	" 3 moister.	82	86	" 4 "	86·3	88·3	" 2·3 "
Mean of 21 days.	58·85	75·28	Aiken 16·43 drier.	41·14	49·95	Aiken 8·81 drier.	50·85	73·23	Aiken 22·38 drier.	50·24	66·12	Aiken 15·88 drier

March.																				
1	61	83	Aiken	22	drier.		48	74	Aiken	26	drier.		50	74	Aiken	24	drier.		53·2	77·0	Aiken	23·8	drier.
2.....	44	72	"	28	"		34	60	"	26	"		59	60	"	1	"		45·6	64·0	"	18·4	"
3.....	51	93	"	42	"		33	69	"	36	"		42	93	"	51	"		42·0	85·0	"	43·0	"
4.....	54	93	"	39	"		42	86	"	44	"		51	93	"	42	"		49·0	90·6	"	41·6	"
5.....	73	93	"	20	"		30	86	"	56	"		66	93	"	27	"		56·3	90·6	"	34·3	"
6.....	68	86	"	18	"		35	45	"	10	"		43	57	"	14	"		51·0	62·6	"	11·6	"
7.....	57	93	"	36	"		33	55	"	22	"		56	77	"	21	"		48·6	75·0	"	26·4	"
8.....	63	80	"	17	"		26	68	"	42	"		50	69	"	19	"		46·3	72·3	"	26·0	"
9.....	53	86	"	33	"		42	93	"	51	"		68	74	"	6	"		54·3	84·3	"	30·0	"
10.....	61	53	"	7	moister.		51	50	"	1	moister.		44	65	"	21	"		52·0	56·0	"	4·0	"
11.....	51	89	"	38	drier.		37	47	"	10	drier.		60	77	"	17	"		49·3	71·1	"	21·8	"
12.....	76	93	"	17	"		80	100	"	20	"		93	93	"	0	"		83·0	95·3	"	12·3	"
13.....	80	100	"	20	"		74	100	"	26	"		56	100	"	44	"		70·0	100·0	"	30·0	"
14.....	57	100	"	43	"		26	60	"	34	"		29	100	"	71	"		38·0	86·6	"	48·6	"
15.....	68	93	"	25	"		63	66	"	3	"		65	100	"	35	"		66·0	86·3	"	20·3	"
16.....	86	100	"	14	"		73	100	"	27	"		86	100	"	14	"		81·6	100·0	"	18·4	"
17.....	86	93	"	7	"		36	66	"	30	"		48	84	"	36	"		56·6	81·0	"	24·4	"
18.....	72	84	"	12	"		61	71	"	10	"		78	100	"	22	"		70·3	85·0	"	14·7	"
19.....	70	100	"	30	"		64	93	"	29	"		78	93	"	15	"		70·6	95·0	"	24·4	"
20.....	90	100	"	10	"		90	100	"	10	"		90	100	"	10	"		90·0	100·0	"	10·0	"
21.....	47	86	"	39	"		35	50	"	15	"		41	93	"	52	"		41·0	76·3	"	35·3	"
22.....	42	66	"	24	"		25	36	"	11	"		33	48	"	15	"		33·3	50·0	"	16·7	"
23.....	47	43	"	4	moister		14	26	"	12	"		37	86	"	49	"		32·6	51·6	"	19·0	"
24.....	36	86	"	50	drier.		22	47	"	25	"		42	86	"	44	"		33·3	73·0	"	39·7	"
25.....	55	86	"	31	"		24	46	"	22	"		48	75	"	27	"		42·3	69·0	"	26·7	"
26.....	70	81	"	11	"		37	51	"	14	"		51	93	"	42	"		52·6	75·0	"	22·4	"
27.....	70	84	"	14	"		50	100	"	50	"		59	100	"	41	"		59·6	94·6	"	35·0	"
28.....	73	100	"	27	"		61	90	"	29	"		72	100	"	28	"		68·6	96·6	"	38·0	"
29.....	93	93	"	0	"		93	82	"	11	moister.		93	100	"	7	"		93·0	91·6	"	1·4	m'ster
30.....	100	82	"	18	moister		58	74	"	16	drier.		76	78	"	2	"		78·0	78·0	"	0	"
31.....	86	74	"	12	"		39	39	"	0	"		42	93	"	51	"		55·5	68·6	"	13·0	drier.
	65·80	85·96	Aiken	20·16	drier.		46·32	68·70	Aiken	22·38	drier.		58·25	85·61	Aiken	27·36	drier.		56·88	80·06	Aiken	23·18	dri'r

that, owing to frequent rains, the relative humidity at Thomasville during the month of March was greatly in excess of the usual mean for that month. The chief object in inserting Table No. 7 is to enable the reader to follow the daily course of the relative humidity.

The only attempt at a classification of climate, according to its relative humidity, is the rather unsatisfactory one of Vivenot, which is as follows:

1. Dry climates..	*a.* Excessively dry.....	1– 55	per cent.
	b. Moderately dry.....	56– 70	" "
2. Moist climates.	*a.* Moderately moist.....	71– 85	" "
	b. Excessively moist.....	86–100	" "

According to this standard, Aiken and Thomasville would both rank as moderately dry climates. The mean relative humidity of Aiken is, however, less than that of any station east of the Rocky Mountains where hygrometric observations have been taken, and during the first four months of the current year was even less than that of Denver, Colorado.* The spring is the driest season at both places, the relative humidity of March being lower than that of all the other months.

In the following tables will be found a comparison of the relative humidity of Aiken and Thomasville with that of some of the large American cities, and of the leading health-resorts in this and foreign countries.

TABLE No. 8.

Comparing the mean relative humidity of Aiken and Thomasville during the six colder months with that of some of the larger cities in the United States.

	Per c								
Aiken	57·9								
Thomasville	63·2	Per c.					Per c.		
San Francisco	72·9	15	moister	than	Aiken	and	9·77	than	Thomasville.
Charleston	72·8	14·9	"	"	"	"	9·6	"	"
Chicago	71·7	13·8	"	"	"	"	8·5	"	"
San Diego	71·2	13·3	"	"	"	"	8·0	"	"
Jacksonville	71·0	13·1	"	"	"	"	7·8	"	"
Boston	69·8	11·9	"	"	"	"	6·6	"	"
New York	69·8	11·9	"	"	"	"	6·6	"	"
Cincinnati	67·7	9·8	"	"	"	"	4·5	"	"
Baltimore	66·3	8·4	"	"	"	"	3·1	"	"

*	Aiken.	Denver.		Aiken.	Denver.
	Per cent.	Per cent.		Per cent.	Per cent.
January	60·50	66·70	March	56·90	65·26
February	51·30	51·70	April	56·20	60·70

TABLE No. 9.

Comparing the mean relative humidity of Aiken and Thomasville during the six colder months with that of some of the principal health-resorts of the United States, Europe, and Africa.

	Per c								
Aiken	57·9								
Thomasville	63·2	Per c.					Per c.		
Pau	82·5	24·6	moister	than	Aiken	and	19·3	than	Thomasville
Davos	76·6	18·7	"	"	"	"	13·4	"	"
Nice	71·0	13·1	"	"	"	"	7·8	"	"
Meran	67·5	9·6	"	"	"	"	4·3	"	"
Cairo	67·0	9·1	"	"	"	"	3·8	"	"
Ashville	63·8	5·9	"	"	"	"	0·6	"	"
Cannes *	62·0	4·1	"	"	"	"	1·2	"	"

This comparison, which is based upon the result of many years of observation, proves that Aiken is from 4 to 24 per cent. drier than all the other resorts mentioned in the table, and, as the list comprises all the well-known stations for which I have been able to obtain reliable data, Aiken may justly be ranked as *one of the driest health stations in the world.* I have been unable to obtain any information as to the relative humidity of Colorado Springs and Manitou, but, judging from the hygrometric conditions of other places west of the Rocky Mountains, these resorts are even drier than Aiken. Thomasville is drier by from 0·6 to 19·3 per cent. than the other health-resorts mentioned in the table, except Cannes on the Riviera, which is 1·2 per cent. drier.

Rain and Snow.—The average amount of rain at Aiken during the six colder months is 23·18 inches. The rain-fall is greatest during the months of March and April, but even in these months it seldom interferes with the out-door exercise of the invalid. Of all the factors of climate, the rain-fall is the most misleading, the total amount varying greatly in different years and seasons. The quantity as measured in inches affords no criterion for judging of the dryness of a locality, as a large amount may fall in a few hours, while a much smaller amount may be distributed over several days. Hence, at health-resorts, the duration of the rain-fall is more important than the quantity which falls. One of the chief objects that an invalid has in view in going south is to be able to pass most of the time in the open air, and as this is curtailed by long-continued rain-storms, it is all-important to determine their duration. Unfortunately, I have been able to collect but little information on this

* According to Hann (*op. cit.*, p. 444), the relative humidity of Meran, Cairo, and Cannes is much higher than the figures in the table.

point in regard to the places under consideration, the only record that has been made being the rather arbitrary one of the number of fair days.

TABLE No. 10.

Average rain-fall and number of fair days at Aiken for eleven years.

	Rain in inches.	Number of fair days.
January	3·64	19¾
February	3·26	19¼
March	4·86	21
April	4·71	23½
November	3·43	19½
December	3·28	20¼
Months	23·18	123
Winter	10·35	19¾
Spring	12·83	21¼

In studying the rain-fall in connection with the out-door life of the invalid, it is also necessary to take into consideration the character of the soil. If the ground is retentive of moisture, especially if it be composed of admixture of clay, the walks become muddy after heavy rains, and hours, and perhaps days, may elapse before they become sufficiently dry to enable the invalid to walk out with safety and comfort. If, however, the soil is sandy and porous, the water disappears rapidly from the surface, and a few hours' sunshine suffices to dissipate all traces of moisture. This is particularly the case at Aiken, where, owing to the sandy nature of the soil and the absence of all moisture near the surface, the ground dries so rapidly, even after the heaviest showers, that all traces of water usually disappear from the surface within an hour or two, thus materially curtailing the time that the invalid is confined to the house.

At Aiken there is usually a slight fall of snow once during the season, but this is generally very light, and a little sunshine is sufficient to remove all traces of it. Thomasville, being a hundred miles farther south, may, for all practical purposes, be regarded as beyond the snow-line. Once only during the last fifteen years, according to Dr. T. S. Hopkins, has that place been visited by a snow-storm. At Aiken, owing to the extreme dryness of the atmosphere, there is little or no dew. Frosts, of course, occur from time to time, but are usually light, and generally confined to the months of January and February.*

* I have been unable to obtain any observations in regard to the rain-fall at Thomasville.

Winds.—At Aiken the prevailing winds are from the southwest, and are remarkable for their extreme dryness. Owing to the north-easterly trend of the North American coast, the northeast wind has to travel over hundreds of miles of the dry pine forests of North and South Carolina, and is thus deprived of most of its moisture before reaching Aiken. Hence, during the first twenty-four or forty-eight hours of the prevalence of such a wind, the atmosphere usually remains clear and bright; indeed, during some of our most delightful days the wind is from that quarter. Strangers occupying houses in an exposed situation are liable to form an impression that Aiken is a windy place, but this is readily dissipated by a walk through the town proper. A year's observation with a Robinson self-recording anemometer shows that the average velocity of the winds is only three miles and a half an hour.

TABLE NO. 11.

Giving the direction and velocity of the wind at Aiken during the six colder months.

	Direction.	Velocity—average number of miles per hour.		Direction.	Velocity—average number of miles per hour.
January	S. W. & W.	3·77	April	S. W.	4·03
February	S. W.	3·84	November	S. W.	2·55
March	S. W.	3·79	December	S. W. & W.	3·04

Summary.—On looking over the meteorological data as given above, we find that the climate of Aiken and Thomasville during the six colder months (November to April) is moderately cold and fairly equable, with sufficient elevation to insure good drainage and free circulation of air, that the days are fair during two thirds of the season, and that the prevailing winds are from a dry quarter and of moderate velocity. At both places the winter is short, commencing at Christmas and terminating early in March, the peach-trees in Aiken being usually in full bloom by the end of February. Compared with each other, Thomasville is by a few degrees the warmer of the two, but, as regards humidity, Aiken is not only much drier than Thomasville, but the driest of all our health-resorts except those located in Colorado and New Mexico.

According to Thorrowgood,* the rule to be followed in the selection of a health-resort for consumptives "is to endeavor to

* Thorrowgood, "Climatic Treatment of Consumption," p. 17.

have a residence on a dry soil and at a moderate elevation, where there will be free circulation of air, and to avoid places lying low where the air is damp, stagnant, and cold." Aiken comes up to these requirements, and the good results attained there in the treatment of pulmonary phthisis afford ample proof of the correctness of Dr. Thorrowgood's views. Several years ago I classified the results in over a hundred cases of phthisis treated at Aiken. Of these, fifteen per cent. were arrested, and most of them permanently, and, of the remainder, fifty per cent. were improved. I regret that I have been unable to obtain any statistics of results at Thomasville.

In preparing this paper I have endeavored to be correct and impartial, and, if I have written in greater detail about Aiken, it is because I am better acquainted with its climate and surroundings, having lived there for upward of seventeen years, while in regard to Thomasville I have labored under serious difficulties, owing to the inability of Dr. Hopkins to furnish me with the requisite data in regard to the winds, number of fair days, etc., Dr. Hopkins having turned over all the recent meteorological observations to Dr. Huntington Richards, for publication in Wood's "Reference Handbook of the Medical Sciences."

Paper.

ROCKY MOUNTAIN FEVER.

By ROLAND G. CURTIN, M. D.

AT a meeting of the Philadelphia Committee of Arrangements of the American Climatological Association it was concluded desirable to have an article on "Rocky Mountain Fever."

Accordingly, a physician was invited to prepare a paper on the subject. At a second meeting, a short time ago, the gentleman who had been so invited was reported as having desired to be excused from compliance with the request of the committee.

The president, knowing that I had had a slight experience with this disease, asked me to lay it before the association, together with other material that was promised from persons living in the Rocky Mountain region. Several letters were written to physicians settled in that locality, with indifferent success. One of those written to had died (as was reported by his relatives). Another had removed, and his whereabouts could not be ascertained. A third had never seen but two cases. Three failed altogether to reply. Two prom-

ised information which has not as yet been received. The only reply bringing with it anything of satisfaction was from Dr. Dougan, of Colorado. It seems fitting to make this statement, by way of premise, as an apology for any disappointment which our perhaps meager paper may occasion. If any additional data should be received at any future time, they will be very gladly presented to the society.

I will now read the paper furnished by Dr. Dougan, after which I will add information gathered from others, following which I will give my own very slight experience in this disease :

The term mountain fever has, by long-continued and frequent use, almost established itself in the nomenclature of disease in the mountain districts of the West. Whether or not its use is proper as designating a separate and distinct type of fever, a pathological entity, may well be questioned. A somewhat extensive acquaintance with the physicians of Colorado warrants the statement that many of them believe that we have in our high altitude a fever not described in the text books, and to which this designation is applicable; while another and perhaps larger portion of the medical profession of the State decline to admit that such is the case. The experience of the writer, based on a practice of two years in the mountains, induces him to class himself with those who regard cases of mountain fever (so called) as belonging to one or another of the well-known and already classified varieties.

The fact must be admitted, however, if we accept the latter view, that the cases present variations, and often wide variations, from the usual course of the fevers to which we would assign them, and it is because of this departure from the course of recognized types that many practitioners have decided to accept the idea of a new variety.

And yet it is not necessary, because the phenomena observed in a case, or series of cases, differ from the phenomena which we usually regard as characteristic of a given form of fever, to decide that we have a new variety to deal with. It is a well-known fact that the general symptomatology of fevers may be modified by environment, and that names may be given them suggested by locality; hence we have the swamp fever of the South, the Panama fever of the isthmus, and the coast fever of Africa, all of which are accepted malarial fevers modified by the conditions existing in the localities where they are found.

Not a few of the cases that are sometimes called mountain fever are ephemeral in character and difficult of classification; but the fever that is recognized as peculiarly entitled to this designation, by those who believe it a proper term, presents many claims to be designated as typhoid, modified, it is true, by causes and conditions peculiar to its surroundings.

It is freely admitted that this assumption is open to argument, that

the position is not sufficiently established to justify dogmatism; but, as it is desirable that the truth should be arrived at, reasons will be offered in support of this view, and no doubt we shall have the opposite side of the question presented in due time.

At the introduction of the discussion we encounter an embarrassment from the fact that there is no accepted description of the clinical history of mountain fever, and that different observers fail in an exact agreement as to its successive phenomena, but the following will no doubt be taken as a fair presentation of the symptoms observed in an average case.

At first we are informed that the patient has become suddenly ill, but a little inquiry usually elicits the fact that he had not been quite so well as usual for a few days. A chill may or may not have announced the commencement of the illness. The temperature is usually 101° or 102° F. at the apparent onset. Sometimes it may be found as high as 104°, and not infrequently it remains nearly stationary until the approach of convalescence, being without the progressive daily increase and characteristic daily remissions usual in typhoid. There is absence of appetite without nausea, the tongue is not dry and but slightly furred, sometimes remaining nearly natural throughout the illness. The bowels are usually constipated, and require an occasional laxative. The skin is dry, but without other peculiarities. While the temperature does not exhibit diurnal changes, it may in some instances fall suddenly one or two degrees, remain at the lower point one or more days, and then as suddenly rise to its former elevation, or the diminution may be permanent, and the further course of the disease be upon the lower temperature level, and this without reference to the therapeutic measures that may have been employed; in fact, quinine in large doses, thirty grains or more, seems powerless to even modify the temperature. Delirium may occur, but is not usual, and the patient rarely suffers from loss of sleep. The course of the disease is comparatively short—from one to two weeks—but it does not appear to end on the expiration of any definite number of days; the tendency is always toward recovery. The simplest treatment is sufficient, nourishment being of most importance. The absence of fatal cases prevents a knowledge of the condition of the intestinal tract, and if any alteration of the Peyerian glands occurs it probably does not advance to ulceration.

Among the reasons for believing the above-described cases to be mild and irregular developments of typhoid are the following:

1. Such cases are usually seen during the season of the year when typhoid is most prevalent—viz., from July to November.

2. They are most apt to occur under conditions favorable to typhoid, such as crowded and badly ventilated sleeping apartments, proximity of decomposing organic matter, impure water, defective drainage, and general disregard of sanitary requirements, conditions that too often may be found in the West as well as elsewhere.

3. Not infrequently a case commencing as above described will, before

its conclusion, present some feature so characteristic of typhoid as to leave no doubt of its nature, such as spots of roseola, diarrhœa, or tympanites.

4. In the high altitudes where mountain fever is said to occur, a large proportion of the cases of undoubted typhoid pursue a remarkably mild course, and cases of "walking typhoid" are not rare. From this we may assume that the climatic conditions here existing are sufficient to moderate the intensity of the disease, and we are perhaps justified by this observation in believing that the same conditions may in other respects modify the phases of its development.

The conditions herein referred to as having a modifying influence on typhoid fever are the purity, dryness, and coolness of the atmosphere. It is hardly necessary to enter into a discussion as to whether such conditions can affect the course of disease; if heat and moisture favor the development of disease-germs, the opposite condition may be presumed to retard it; and, even though these causes may be inoperative within the body, they may so impress the prehuman or extra-human life of germs as to alter the usual developmental processes that they undergo within the human organism. As a matter of fact we do not see this modifying effect of atmospheric conditions in our observations of other diseases. It is not maintained that all the effect of atmospheric conditions as related to fevers is exerted on the disease-germs. The entire condition of the patient may be modified by the same causes; respiration, circulation, digestion, nutrition, and the condition of the nervous system, may all be more or less influenced by the peculiarities of the atmosphere, and each contribute toward the clinical history of a case.

If by the term mountain fever we understand simply that we hereby indicate mild cases of typhoid occurring in the mountain districts, the use of the term, while unscientific and objectionable, may still be tolerated as satisfactory, especially to the laity; but if it is to be understood as designating a specific disease, let us wait for clinical and pathological proofs before admitting it into the literature of the profession.

D. H. Dougan, M. D.

322 Storet Street, Denver, Col.

In looking over the scanty literature on the subject, I have found in print the following allusions to the subject under consideration:

Dr. Charles Smart, of the U. S. Army, in an extensive article upon "'Mountain Fever' and Malarious Waters," in the "American Journal of the Medical Sciences" for January, 1878, arrives at the conclusion that the "camp fever" of our civil war and the "mountain fever" bear a striking resemblance to one another, and considers the latter to be a mixture of malarial and typhoid fever poisons.

Dr. Hall, of the U. S. Army, in an article in the January number of the "American Journal of the Medical Sciences" for 1880, entitled

"Typho-malarial Fever, the so-called 'Mountain Fever' of the Rocky Mountains," gives a careful account of many cases observed by him, and furnishes the following deductions:

1. The fever of the Rocky Mountain region is a hybrid disease, the prominent features of which are typhoid—the modifying, intermittent; is, in fact, the typho-malarial fever of Woodward.

2. It appears during or after the exposure incident to field-service, generally, though not necessarily, in late summer and early autumn, and seems to bear no relation to typhoid infection, as now usually accepted by the profession.

3. At its inception, this disease manifests itself as an intermittent of quotidian, tertian, or other form; this stage is followed (in about two weeks) by the typhoid stage, lasting in the neighborhood of four weeks, in which typical typhoid symptoms may be observed, modified to a greater or less degree by intermittent indications.

4. The pathological anatomy of the disease is that of typhoid fever.

5. The treatment should be antiperiodic and antipyretic.

A physician who resided temporarily in Montana informed the writer that he had followed the practice of a doctor located there for the purpose of observing "mountain fever." Four cases were pointed out to him as typical cases of this disease. My informant examined them carefully, and found all the physical signs of croupous pneumonia, with the ordinary symptoms incidental to the latter disease.

In 1868, while an assistant on the U. S. Geological Exploring Expedition under Professor Hayden, while in Cheyenne City, Wyoming Territory, it was my fortune to see in a private hospital four cases diagnosticated as "mountain fever." In two of these cases the patients were "prospectors," men who had been engaged in seeking after the outcroppings of the precious metals in the fastnesses of the mountains at a great altitude, camping out along the streams, and leading a nomadic life in general. The other two were cases of persons who had been living in canvas tents while at home, and yet had often been called by business to the mountains. One of the patients died during the third week, no post-mortem being made in his case. At some period of the disease they all had more or less diarrhœa, which in one case was continuous and very marked throughout the whole course of the disease. In one case I noticed there was a doubtful "tache rouge," coming in crops and disappearing on pressure. The margin of the spots was poorly defined, and not circular in shape. (This patient recovered.) One had epistaxis at the beginning of the disease. Tympanites was more or less

marked in all the cases. In conversation with the physician who had these cases in charge, and who had been established in the region for some years, he informed me that the symptoms were about the same as those observed by him in other cases called "mountain fever." To me the cases appeared to be of typhoid fever or typho-malarial fever.

We will now proceed to study the salient points of the information laid before us.

In Dr. Dougan's paper he informs us that the temperature is usually 101° to 102° at the commencement of the attack, and that not infrequently it remains nearly stationary until the approach of convalescence, being without the progressive daily increase and characteristic daily remissions usual in typhoid and (I might add) remittent fever.

Absence of appetite without nausea is, according to the doctor, another symptom.

A constipated condition of the bowels was also noted by him. He also observes that the course is comparatively short—from one to two weeks.

No dryness of the tongue was ever observed by the doctor in any of his cases.

The tendency was always toward recovery.

The symptoms given by Dr. Dougan in some respects seem to tally with those given as of simple continued fever.

With regard to the mortality, as before stated, Dr. Dougan observes that he never had a fatal case, while the physician with whom I conversed in Cheyenne City informed me that one out of every eight or ten died.

I have conversed with several shrewd and competent physicians on the subject, all of whom agree with Dr. Dougan that the "Rocky Mountain fever" is not a separate and distinct disease, but that it is fever of other well-known forms, modified perhaps by climatic influences.

It seems to me that the following causes may have led to the assumption that there is a febrile affection peculiar to the Rocky Mountains:

Inaccurate observation may have led to errors in diagnosis. In the early history of the Rocky Mountain region the class of physicians there located perhaps included many who were probably unable, from habit and limited education, to observe with that degree of closeness which is requisite at all times for a proper diagnosis. I make

this statement because the cases coming under my notice were either of typhoid fever or typho-malarial fever. A physician in Montana mistook croupous pneumonia for "mountain fever." Another influence probably at work was fashion. We have fashions in medicine in various directions. It shapes our stethoscopes, it changes our treatment, and why may it not also change the names of diseases? In our own midst we have an example of this. Almost every infant or young child in Philadelphia that dies of bowel trouble is reported as having died of cholera infantum; enterocolitis, diarrhœa of dentition, summer diarrhœa, and other fatal diarrhœas are often grouped under this head. This fact is the occasion of surprise and remark among the profession abroad at the frequency of cholera infantum in this country, presenting a strong contrast to the comparative rarity of the disease among them. Thus it would appear with all febrile affections in the Rocky Mountain region. They seem to have been grouped under the head of "mountain fever." The peculiarities of climate may have had some effect on them, making the different varieties appear somewhat alike to the superficial observer.

I will now give you a brief account of the impressions made upon my mind as to the climatic and other influences at work in the Rocky Mountain region. These conditions which might modify disease suggested themselves to me during my brief sojourn there:

1. *The altitude*, which lowers the temperature and rarefies the atmosphere.

2. *The purity and dryness of the air.*

One of the prominent local features of a large part of the Rocky Mountain region, and a factor liable to modify disease, is the alkaline condition of the earth's surface. The granite and other rocks found at the summit of the mountains decompose easily, and, when they break down, the salts of calcium, sodium, and magnesium are liberated and spread over the surface. The soil is often seen with an efflorescence of these salts on the surface, sometimes giving it a whiteness resembling snow. It is also seen on the margins of the ponds and lakes. The streams are often so bitter that it is impossible to drink from them, and streams less affected will often cause a diarrhœa. This condition of the water might produce a diarrhœa in a malarial fever, or simple continued fever. When the wind blows, the sand and dust, impregnated with the alkalies, are set in motion. Of course this causes great irritation to the air-passages, and renders the atmosphere unfavorable for those afflicted with throat and lung

diseases. This condition of the air might in a fever patient occasion a cough similar to that usual in typhoid fever.

The water usually found is that of the streams running down from the melting snow at the summit of the mountains. This scarcity of water has a tendency to make travelers and "campers out" careless about bathing, as indeed, also, the temperature of the water itself, which is apt to be too low to admit of bathing with comfort and safety.

This condition of affairs, occasioning personal uncleanness in connection with the excessive fatigue incident to the life and habits of the early mountaineers, doubtless rendered them susceptible to simple continued fever. In camping in that region, it is usually along the streams, so that water can be readily secured; this again favors the imbibition of malarial poison.

A fever called the "mountain sickness" is said to prevail in the Andes, in South America; and a fever has also been reported among the Himalayas, the highest mountains in the world.

To sum up, first, it would appear that in the Rocky Mountain region almost every disease with a febrile reaction has been called "mountain fever." Secondly, proof is wanting that there is a separate and distinct disease peculiar to that region.

The following letter will explain itself:

FORT BENTON, MONTANA, *June 10, 1886.*

Dr. Roland G. Curtin:

DEAR DOCTOR: My excuse as a stranger for addressing you is the great pleasure your paper on "Mountain Fever," read before the American Climatological Association, gave me. I have been a resident practitioner in Montana since 1879, and during that time I have not seen a case of fever different from the "already classified varieties." I have been criticised for even doubting it, and saying, if such a type existed, it had escaped my observation. As I said, your paper gave me great pleasure, and I hope you will not consider me intrusive for expressing it.

Very respectfully,

F. ATKISSON.

Paper.

HEALTH RESORTS OF MEXICO.

By HENRY D. DIDAMA, M. D.

FOR the facts and opinions recorded in this paper I am indebted, as will be seen, almost exclusively to Dr. E. Below and Dr. Archibald Lawson, both accomplished physicians residing in the city of Mexico.

Dr. Below has rooms fitted up in his residence, and also at Tacubaya, in the suburbs of the city, for the accommodation of sick strangers, especially consumptives.

His opportunities for observing the effect of climate have been abundant, and his clinical experience has been great. His philosophical turn of mind will be manifest as I read from his communication.

He begins his letter by giving a detailed account of a case of consumption which occurred several years ago, where mercurials administered—not for the disease itself, but for a complication—effected a marvelous cure.

The patient was a clergyman. He had all the characteristic symptoms of phthisis florida—cough, elastic fibers in the sputa, hectic, great emaciation, hoarseness, snake-head fingers, etc.

No hope of recovery was entertained by any of the physicians who saw him in council. His restoration after mercurialization by inunction was speedy and entire. The cavity in the lung healed and all the symptoms disappeared.

The doctor now attributes the favorable result to the bacillicide potency of the mercury.

If the distinguished patient had not been a clergyman, a faint suspicion might be awakened, in the minds of those disposed to cavil, that the mercurialization achieved its beneficent success by destroying organisms other than the bacilli of tubercle. The details of the case are full of interest, and deserve a place in some of our medical journals. Even before the discovery of the *Bacillus tuberculosis*, the treatment of consumption in the city of Mexico by calomel, combined or not with iodoform, had been attended with considerable success. This success, however, the doctor attributes in great part to the aseptic air of the country.

The city of Mexico, with a population of 250,000, is at the bot-

tom of a basin sixty miles in length, and elevated 7,500 feet above the level of the sea. The protecting rim of the basin extends without break around the entire valley, and is 1,000 feet in height above it, so that, in journeying to the interesting city, the traveler ascends to the height of 8,500 feet and then goes down 1,000 feet to the lovely valley below.

The drainage of Mexico city is into Lake Texcoco, situated near the city, and on a level but a trifle below. For more than two centuries the sewage of the town has sluggishly found its way into this shallow lake, which has no outlet. The stench from the clogged sewers is appalling. The multitudinous bad odors of a certain continental city are cologne in comparison. Hygienic measures are neglected in asylums and even in hospitals. Listerian and other cleanliness is ignored. And yet such is the tenuity of the air—where water boils at about 196° F.—and such is its dryness, that pyæmia, septicæmia, and hospital gangrene are practically unknown.

Cadavers in the street and dissecting-rooms, as I had occasion to notice, and even in the cemeteries, mummify without odor, instead of putrefying, as with us.

Dr. Below believes that the quality and consistence of the air of these Mexican highlands, where the largest cities and healthiest places are situated, are decidedly unfavorable to the proliferation and propagation of noxious microbes.

He suggests that experimentation with *Bacilli tuberculosis* at different altitudes and temperatures, in various cities and countries, should be made, to determine what favors, what hinders, and what arrests the growth of these micro-organisms. The suggestion is worthy of practical attention.

I give a few of the doctor's thoughtful deductions:

1. Tuberculosis is a septic process on a cellular tissue, tender, and vulnerable from heredity.

2. The aseptic air of Mexico gives the best chances for a favorable progress and termination of this septic process.

3. Even if the hereditary state is not influenced by the air of the Mexican highlands, the *new* septic process is *surely cured* if promptly subjected to the influence of the aseptic air and antiseptic remedies.

4. Without any antiseptic remedies, a short stay in the Mexican climate suffices to remove the infectious character of the sputa, except in inveterate cases.

5. The fever following hæmorrhages is arrested sooner than in northern climates, where the air is thick and damp.

6. Hopeless patients brought from the North experience mitigation of their sufferings and better enjoy their last months of living.

7. Tubercular consumption is not prevalent in Mexico.

8. In January, when the "northers" come, and in April and May, before the rainy season sets in, and when the air is full of dust, catarrhal pneumonia is not infrequent. At this time tuberculous and catarrhal cases are sent to altitudes lower than Mexico city.

9. The "*tierra templada*"—the table-land, where the larger cities are—ought to be chosen for tuberculous patients.

10. The highest location—"*tierra fria*"—and the low, swampy one—"*tierra caliente*"—should be avoided by them.

Dr. Lawson is a young and wide-awake physician. His practice is confined mainly to American and English residents and visitors. He is a careful observer, but he has had comparatively little experience with tuberculous cases. He confesses that to him, personally, the climate is delightful. But he holds some views regarding the Mexican capital which are not in strict accordance with those expressed by Dr. Below. He looks upon the altitude of this city as too high for consumptives. The air is too rarefied, and it demands more work of the heart and lungs than is at all beneficial. The changes of temperature are also great: the mornings cool, 65°; from 11 A. M. to 3 or 4 P. M. very hot, 90° to 100°, and even 120° in the sun; the evenings very cool, and in winter cold and penetrating, down to 60° and 55°.

From May to October is the rainy season, and rain may be looked for every afternoon, usually accompanied by thunder and lightning. After the rain, vapors arise, rendering the night-air not only cold but damp, and making it specially bad for pulmonary and catarrhal diseases, of which there are many in Mexico. Those who have any tendency to hæmorrhages are injured by the rarefied air, and are liable to more congestion. Nevertheless, some forms of chest trouble are benefited.

My own observations, during a visit of nearly two months in the dry season, from about the first of March, lead me to indorse some of the statements of Dr. Lawson.

It is asserted by the compilers of Mexican guide-books and veracious inventors of statistics that in the city of Mexico the temperature is never above 70° in the shade and never below 50°—making the thermometric range from the hottest day in summer to the coldest night in winter but twenty degrees. The assertion must be taken with some modification and explanation.

Water has been known to freeze on some exceptionally cold nights. The difference between the temperature in the sunshine and in the shade is remarkably great.

In the shade the thermometer might indicate but 70°, while a few feet distant, in the sunshine, the mercury would run up to 110°, and even 120°. At our low altitudes this great difference never exists. The explanation, I dare say, is that the thin air at this great altitude is not heated by the direct perpendicular rays of the sun, which pass unrestrained through it, and bestow their intense ardor upon the unprotected head of the unwary traveler.

The usual effect of passing from the glowing sunshine of the street to the cool air of the sidewalk is a succession of sneezes. Catarrhal troubles were notably and necessarily prevalent, and their persistence was a marked characteristic. I saw many poor wretches who coughed violently and who were extremely emaciated; but I am not prepared to contradict the astonishing statement, made by a patriotic hospital surgeon, that nobody dies of consumption in Mexico. Dr. Lawson kindly furnishes a list of health resorts, and describes their peculiarities and advantages. He names Puebla, Aguas Calientes, Orizaba, Tuzpan, Canabla, and some villages on the outskirts of Mexico city as being considered specially healthful.

Puebla is a large place, clean, with good hotels and Mexican doctors. Its altitude is 7,000 feet; it is accessible by rail from Mexico or Vera Cruz. Board and lodging, three to four dollars a day.

Aguas Calientes, on the Central Railway—one mile from the station—between El Paso and Mexico city, has a fine climate, good hotel accommodations, American and Mexican physicians, and an altitude of 3,000 feet, and is warmer and drier than any of the other elevated cities. Its name is derived from its famous hot springs.

Orizaba—population 20,000, altitude 3,500 feet—is warm, but not oppressively so, and damp. It is subject to "northers" in the winter. It is resorted to by citizens of Vera Cruz in the summer. In full view of it is the magnificent mountain cone, Orizaba, which raises its silvery head 18,000 feet into the heavens.

Tuzpan, on the Gulf of Mexico, about one day's journey from Vera Cruz—warm, low situation, healthy, no yellow fever, good bathing, little if any medical supervision, no railways—is probably the best resort for pulmonary troubles of all kinds.

Canabla, on the border-land between the Tierra Caliente and the high land, is a favorite resort for convalescents from the city of Mexico. It is warm, balmy, and pleasant in winter, but hot in sum-

mer. It has an elevation of 2,500 feet, and had inferior hotel accommodations one year ago and little medical supervision.

The villages of San Angel, Tacuba, Tacubaya, Chapultepec, and others in the vicinity of the capital, are all nice in their way. The air is fresh and balmy; the nights are cool. The healthful advantages of the city of Mexico are enjoyed, free from its pernicious influences and its wretched drainage.

The doctor concludes by stating that, notwithstanding the prevalence of tuberculosis and remittent fever, one with care can manage to preserve and enjoy excellent health.

Personally, I found the climate too equable to be fascinating. The days had the family resemblance of a succession of the new eighty-cent dollars coined at the Mint. Unlike the stars, they did not differ the least in glory.

A continual flood of cloudless sunshine for two weary months became as monotonous, not to say cloying, as the traditional sixty consecutive meals of boarding-house hash. But, for consumptives and all others who need thin air and a superabundance of unadulterated and undiluted sunlight, the climate of many parts of the Mexican republic can not be surpassed in the world.

Paper.

THE SOUTHERN ADIRONDACKS.

By EDWARD T. BRUEN, M. D.

THERE are four principal routes by which the Adirondack region can be penetrated: the Ausable route on the east, the Fulton chain from Trenton Falls, the Ogdensburg route, and, lastly, the southern entrance from Saratoga. Thus it happens that one may speak of the southern Adirondacks from its gateway, and yet the district to which I would invite attention lies almost in the center of the Adirondack district. The climate of the Adirondacks has received considerable attention, yet the vicinity of Blue Mountain Lake has been less visited by tourists and invalids than other parts, and I hope to show that the extensive pine forests which are included in this region are a feature which is not possessed by many other portions of this wilderness more generally known. The entire region around Raquette and Forked Lakes is suitable for camps, and is convenient to the base of supplies—Blue Mountain Lake. I feel satis-

fied that no one should venture to prescribe a residence in any latitude without, if practicable, some personal experience of its merits and defects. It is manifestly impossible for the majority of us to accomplish this, even in a measure. It has, therefore, seemed to me that the statistics and observations I have to offer may be of some interest, as giving a fair idea of a region which is confessedly growing in importance as a health resort.

Blue Mountain Lake lies in a basin formed by the Blue Mountain on the north and a ridge of mountains on the south side. The altitude of the lake is about 1,800 feet above sea-level, and close by is the point of the divide of the Hudson and St. Lawrence water-shed, from which the waters of the Blue Mountain Lake, and the chain of lakes with which it is connected, flow northward.

The prevailing winds are north of west, which is chiefly owing to the basin-like position of the lake in relation to the environing mountains. The northern, western, and southwestern winds sweep round through the northwestern cleft in the range of hills. The eastern and northeastern, however, come in through an opposite cleft to the southeast.

But, however geographical or meteorological conditions recommend any district, there are certain conditions as to housing, eating, and drinking which are necessary to those seeking health, and too often overlooked. How frequently our patients return from southern Colorado or New Mexico with the complaint that a well-regulated and prepared diet was unattainable, some being obliged to subsist exclusively on milk, or go to the expense of renting a house and establishing a private kitchen! Blue Mountain Lake is well equipped to overcome the discomforts which the invalid traveler must encounter. With the exception of Paul Smith's, there is no hotel accommodation which can compare with it in the Adirondack district. The Prospect House is a large building, situated on the southern shore of the lake. A fair idea of the dimensions of the building can be obtained by the statement that a piazza extends 370 feet along the northern and a portion of the eastern and western sides. There is also a wing built from the center of the main building, with a piazza on the southeast 150 feet long. These piazzas, which are 43 feet above the level of the lake, make it possible at all times to secure a sheltered and sunny out-door promenade. The house itself is spacious, with open fire-places in the halls and parlors, and is heated throughout with steam. In this wild region the table, the furniture, and the attendance would do credit to a Saratoga hotel. The Pros-

pect House is naturally the feature of the place as a summer resort; but for winter guests a smaller house has been built, called a cottage, capable of accommodating some thirty or more persons. In many respects this latter house is a more favorable habitat than the larger building. There is furnace-heat in the halls, but each room is provided with an open fire-place, and the compact plan on which this cottage is built insures its warmth and comfort. The piazza is inclosed with glass, an obvious and rare advantage. This cottage is situated to the east of the hotel, on the side of a hill some 75 feet above the lake-level. There are also other boarding-houses and hotels in the vicinity, and numerous private camps, especially as one passes up the chain of lakes.

The claims of the Adirondacks in general seem to rest upon the purity of the air and water, the moderate altitude, their natural beauty, the diversions and attractiveness of forest-life, and their accessibility to those of us who live in the Eastern and Middle States. This region can be reached by train leaving New York at 6.20 P. M., to which, this season, a Pullman sleeper is attached, and this train arrives at 8 A. M. at North Creek, the present terminus of the Adirondack Railroad, some fifty miles from Saratoga. From that point there is a good turnpike, on which quite recently more than $10,000 has been expended, leading directly to Blue Mountain Lake. This ride can be performed by carriage, which will place one at the lake by one o'clock, or the journey can be broken and fair accommodations obtained on the way.

This region of the Adirondacks is virgin forest, mostly pine, thus differing from the Saranac and St. Regis districts, in which the woods are mostly deciduous trees. Moreover, in the St. Regis district and to the eastward the forests have been extensively lumbered, and the ground is barren or covered with small second-growth timber. Common experience has long since determined that the pine woods are a most suitable place of residence for pulmonary invalids. The turpentine exhaled from these pine forests possesses, to a greater degree than all other bodies, the property of converting the oxygen of the air into ozone, and, as this latter destroys organic matter, the air of such forests must be very pure, and consequently conducive to respiration. In addition, the ground, covered as it is with the falling pine, is porous and capable of rapidly absorbing moisture in any ordinary seasons of rain—a fact which many of us have observed in our adjacent resort, Lakewood.

In a paper read before the Austrian Meteorological Society by

Schreiber, the *heilende Princip*, or real healing property in climatic health resorts, is, to quote his words, very simple, "being, in fact nothing more than pure air, uncontaminated by miasma, with no organic or inorganic substances, and one in which meteoric precipitation (rain) is not unduly deficient." It has been noticed in the Adirondacks that a beam of sunlight falling through the leaves never shows a trace of dust. Far be it from me to depreciate or undervalue the beneficial effects of other climates which possess well-recognized advantages for those afflicted with pulmonary disease. But I can not refrain from drawing a contrast between the Adirondack atmosphere in its purity with the storms of dry dust so common in the Colorado and New Mexico districts, which may be so dense as to conceal objects like a mist. Schreiber, whom I have already quoted, mentions an illustration of the supreme importance of breathing pure air which is quite striking. In a recent typhus epidemic in Vienna, the physicians, nurses, and others in the various hospitals of Vienna were all attacked with the disease, but in the Rothschild Hospital in the suburb Währing there was not a single instance of contagion, although numerous cases of the disease were treated there. This latter is the only hospital in Vienna which is provided with a ventilator in the cellar, worked with steam, by means of which the air in every room is emptied and renewed.

One must always consider the question of the water supply as of prime importance to any health resort. In many of the Western States much visited by invalids—regions, I repeat, I think highly desirable from many standpoints—the traveler is met by a new danger in the bad character of the water, especially in southern Colorado and New Mexico. At Blue Mountain Lake, the Prospect House is supplied with drinking water from a pure mountain spring, and good water is everywhere obtainable in this region. The altitude of the Blue Mountain region seems to me a feature of some importance. Pasteur has proved that organic substances are much more numerous on the plains of the earth's surface than in the higher strata of the atmosphere, and they continue to diminish the higher we ascend, disappearing entirely when we reach a certain height in the mountains. In the Adirondacks, at a moderate altitude, this atmospheric purity can be obtained and distinct advantages accrue. For instance, it is possible for persons to live in the Adirondacks for certain seasons, and also to spend intervals of selected time in their homes. It is quite the contrary, according to the practical test of experience, for those living in high altitudes to revisit,

even for short periods, their native cities. Moreover, the process of acclimatization is not so trying. To take an illustration from the climate of Colorado by way of contrast. It is well understood by stock-raisers that horses taken from the East to these high altitudes must have six months' rest, and small animals sometimes die from the change. Further, I think it probable that great altitude is not a cardinal factor in selecting a suitable climate for pulmonary disease, since phthisis is met with in every latitude, and, on examining the climates of those territories which enjoy more or less immunity from that disease, we shall not only fail to find any analogy in their meteorological character, but even discover in this respect the greatest dissimilarity. Schreiber gives as examples of some of these:

	Latitude.	Coldest month.	Warmest month.	Annual mean.
Akureyri, Iceland	65° N.	28·40° F.	56·12°	40·10°
Orenburg, in temperate zone	51° N.	3·93° F.	69·80°	35·96°
Madras, in torrid zone	13° N.	77·00° F.	88·16°	81·50°

Inquiries instituted in Saxony, at the expense of that government, have disclosed that in the very high localities of Erz and Riesengebirge a large percentage of phthisis developed as soon as the inhabitants turned their attention to the industrial arts, such as mining and the manufacture of china; while, on the other hand, the percentage in the lowlands was diminished when the people were engaged in agriculture and cattle-raising. This result is certainly in consonance with the steady current of our notions as to the ætiology and pathology of pulmonary phthisis.

	HIGHEST TEMPERATURE.			LOWEST TEMPERATURE.			Average temperature for 3 years.
	1883.	1884.	1885.	1883.	1884.	1885.	
January	41	40	50	1	...	−18	18
February	49	52	40	1	.....	−12	19⅔
March	46	62	60	.....	3	.....	25⅓
April	67	.....	.....	5	.....	.....	37
May	79	.....	.....	29	.....	.....	49
June	80	.....	.....	35	.....	.....	62
July	81	82	.....	43	37	...	61
August	78	84	.....	41	34	.....	60
September	72	80	86	30	30	41	54
October	80	68	.....	17	4	.....	42
November	64	51	50	11	5	15	29
December	35	50	45	.....	−28	9	23⅓

Thermometrical records have been kept at Blue Mountain Lake, showing the maximum and minimum temperature in the twenty-four hours for three years—viz., 1883, 1884, and 1885. The general average of the temperature reads as in the preceding table.

These temperature records seem to show that this locality is particularly favorable as a winter climate. The cold is not so great as to interfere with out-door exercise, and yet intense enough to secure a dry atmosphere during the major part of the time. The combination reads: dryness, purity of air, without marked diurnal variations of the thermometer. The western blizzards are unknown, and, although at times the winds are high, yet it does not blow so violently as in certain western districts, while the accommodations are most satisfactory. My records, it is true, show that occasionally days occurred which were not satisfactory—but they were very few. For instance, in 1883 it rained once in January; in 1885 there were four days of rain. In February of 1883 there were two days in which there was some rain, and in December about a similar record prevailed.

The month of March, so disagreeable in other latitudes, is here about the same as December, growing warmer toward April. In 1883 there were only six days of high winds, and in 1885 only three. In the first year, March showed there fourteen beautiful days, and the other years fifteen. Lastly, when April is somewhat advanced, the invalid can retrace his steps homeward. Cold climates suit some healthy persons better than warm, while with others the reverse is true. It is well to take this into account. I incline to think that—individual peculiarities aside—more benefit can be derived from the cold. The characteristics of the summer climate need no comment at my hands; the fly-nuisance is reduced to a minimum by the last of June, and the insect practically vanishes as a plague by the middle of July. I think there are more rainy days in the Blue Mountain region than in the St. Regis, but the woods dry rapidly and the rains are seldom long continued, excepting in September, which in its latter weeks may be rainy. It may also be argued that air is mechanically cleansed by rain and snow, as it is chemically purified by ozone. Rain, as it were, washes out the atmosphere and carries with it to the ground not only its solid particles, but also its carbonic acid and ammonia, so that, unless in exceptional seasons, when rain is long continued, the unpleasantness may be salutary.

If I were to indicate in closing a few observations based on the

character of cases which one should select in which to send the patients away from home, it might justly seem as though I could say nothing new on this trite theme. It is a matter of painful experience that persons spend time and money and become exiles from home only to fall victims on the pathway to their El Dorado. In the complex clinical picture so many ætiological and clinical factors appear that it is impossible to consider them briefly. The element in prognosis from the standpoint of pathology is the division of the pulmonary tissue involved and the localization of the disease to a small area. For, even if breaking down of the lung occurs, the limited area involved becomes a prominent prognostic symptom.

The cases most suitable for climatic treatment seem to me to be those in which the lungs are thickened and the vesicular structure not consolidated. In such cases, with or without bronchial catarrh, advantage can be sought from the climate cure—even in hereditary and tubercular phthisis —and I would include in this group cases in which limited local softening has occurred. The patients sent from home must be capable of living out of doors, and this precept often will determine whether one shall choose for a patient a cool, cold, or warm climate, the sea voyage, or the seashore. It would seem that, since chronic bronchitis is often so favorably modified by the sea air, a sea voyage may benefit those cases of phthisis in which the element of catarrhal bronchitis is a prominent factor. At sea the dampness and the high winds do not seem so unfavorable as on the sea-coast, and it is proverbial how the insular climate of small islands (otherwise suitably situated) may often benefit chronic bronchitis.

But it should be borne in mind that, when it is deemed undesirable to send a patient away from home, much benefit may be obtained by suitable attention to domestic hygiene. At home, with proper expenditure in securing appropriate heating and ventilation, with a suitably arranged dietary, one of the prime factors in the treatment of this scourge, one can often secure superior results, and one is tempted to severe reflections upon the misuse of the climate cure.

Paper.

THE CLIMATE OF EL PASO, TEXAS.

By E. W. SCHAUFFLER, A. M., M. D.

Mr. President and Gentlemen: I propose in the present paper to lay before you very briefly such facts as a recent visit to that place has enabled me to collect with regard to the climate of El Paso, Texas. I do so because I believe El Paso to possess one of the best winter climates in the United States, while it is at the same time in the near neighborhood of some of our most salubrious summer resorts, such as the Hot Springs of Las Vegas, N. M.

In presenting to you its qualities I rejoice in the assurance that I repeat to you no twice-told tale, for the town itself is but five years old, and I am not aware that its advantages as a winter resort have ever been brought to the notice of any body of medical men.

El Paso is situated at the extreme western boundary of Texas, in that tongue of land which is bounded on the north and west by New Mexico and on the south by the Rio Grande River. Its longitude is 106° west and its latitude 32° north, the longitude being the same as that of Santa Fé, N. M., and the latitude nearly the same as that of Savannah, Ga., and San Diego, Cal. It is 340 miles south of Santa Fé, constituting the southern terminus of the Atchison, Topeka, and Santa Fé Railroad, and the point where this road connects with the Mexican Central Railroad. Three other trunk lines—two from the East and one from California—center here, bidding for the Mexican trade, and thus what was five years ago a sleepy little settlement under the wing of Fort Bliss has now become an active, enterprising town of some five or six thousand inhabitants, with much actual business and boundless expectations.

The mountain ranges of New Mexico and old Mexico abutting on the river at this point give variety and beauty to the landscape, and contribute that exhilarating quality of "mountain air" which, combined with the mild temperature of the winter season, constitutes the charm of the El Paso climate.

The altitude is 3,760 feet above the sea-level—high enough to be pure and bracing, and yet not high enough to embarrass the heart's action and increase the dyspnœa of those affected with pulmonary

complaints. I found it true with regard to myself while suffering from a severe attack of bronchitis, and also with regard to others whom I met, that whereas at Las Vegas and Santa Fé (at an altitude respectively of 6,700 and 7,100 feet) we suffered from dyspnœa and had to walk slowly, like confirmed invalids, the descent to El Paso enabled us to walk briskly and soon made us feel equal to running a foot-race.

The soil is sandy and very porous.

The temperature is hot in summer, mild in winter. For those who have the means of traveling, it would be folly to summer in El Paso, and yet the dryness of the atmosphere is such that a temperature of 100° to 105° in the shade is more endurable than that of 80° to 85° in Philadelphia. Sunstroke is unknown, in spite of a maximum temperature of 110° in summer, and those who are compelled to remain there do not perish with the heat, nor suffer much if any more than the inhabitants of Eastern cities.

But it is the winter temperature to which I wish to call attention, as well as the small amount of rain-fall and the small number of cloudy days, these conditions combining to constitute the charm of the winter, during which seasor the invalid can walk, or even sit out of doors, almost every day. Combined with the mild temperature there is, as I have before remarked, a bracing, tonic quality to the air, due, perhaps, in part, to its rarity and dryness, which I have failed to find in the air of Florida, of the Gulf, or even of San Antonio, Texas.

The following tables of temperature, etc., are taken from the report of the Chief Signal Officer of the United States army, a signal station having been maintained at Fort Bliss, one mile from El Paso, for the period covered by this report:

YEAR AND MONTH.	TEMPERATURE.				Rain-fall and snow, in inches.	NUMBER OF DAYS.				
	7 A. M.	3 P. M.	11 P. M.	Mean.		Clear.	Fair.	Cloudy	Rain.	Snow.
1881.										
July	70·5	91·5	78·8	80·3	8·18	5	23	3	9	..
August	70·7	88·4	76·0	78·4	3·15	16	12	3	15	..
September	63	85·3	70	72·8	1·44	19	7	4	5	..
October	55·4	79	64·1	66·2	1·45	13	18	0	10	..
November	36·3	58·6	46·2	47	·5	19	9	2	2	..
December	35	57·1	43·6	45·2	·78	19	11	1	3	..
Total or mean	....	....	....	64·9	15·50	91	80	13	44	..

YEAR AND MONTH.	TEMPERATURE.				Rain-fall and snow, in inches.	NUMBER OF DAYS.				
	7 A. M.	3 P. M.	11 P. M.	Mean.		Clear.	Fair.	Cloudy	Rain.	Snow.
1882.										
January	35·1	53·3	43·7	44	·64	15	12	4	4	..
February	37·8	56·2	47·3	47·1	·78	16	7	5	5	..
March	43·3	67·0	55·4	55·2	·38	21	6	4	4	..
April	49·1	75·2	60·7	61·7	...	23	5	2	0	..
May	55·3	83·8	70·2	69·8	·10	27	3	1	1	..
June	65·8	93·3	77·8	79	·43	16	13	1	7	..
July	71·8	96·8	87·5	83·4	1·26	16	13	2	9	..
August	66·5	88·4	75·1	76·7	2·52	18	9	4	11	..
September	57·5	82·1	67·8	69·1	·40	24	4	2	5	..
October	44·3	75·9	59·2	59·8	...	28	3	0	0	..
November	40·8	60·7	49·3	50·3	1·46	15	10	5	7	..
December	33·1	54·2	42·3	43·2	...	27	4	0	0	..
Total or mean	....	....	....	61·59	7·69	246	89	30	53	..
1883.										
January	32·2	52·6	42·7	42·5	·10	20	10	1	3	..
February	40·3	57·8	49·5	49·2	·40	10	12	6	6	..
March	48·9	65·0	55·7	56·5	2·09	16	9	6	3	..
April	49·7	72·5	60·2	68·8	·10	26	3	1	1	..
May	60·1	83·1	71·4	71·5	·02	26	2	3	1	..
June	71·1	95·3	81·7	82·7	·02	24	6	0	2	..
Total or mean	....	....	....	60·5	2·73	102	42	17	16	..

In looking at these tables, I would especially call attention to the large number of clear and fair days and the small amount of rain-fall shown during the winter months.

The following table of the mean monthly temperature, the rain-fall, and the number of clear, fair, and cloudy days during the year 1884 is taken from a pamphlet published by the El Paso Bureau of Information, and is entirely consistent with the Signal-Service reports of previous years:

1884.	Mean temperature.	Rain-fall in inches.	Clear days.	Fair days.	Cloudy days.
January	39·9	·55	15	13	3
February	50·6	·84	14	12	2
March	54·5	·33	19	* 9	3
April	59	·91	16	13	1
May	69	none	19	10	2
June	78·4	·11	19	9	2
July	85·5	·46	11	16	4
August	79·6	3·98	5	16	10
September	72·7	3·68	15	10	5
October	62·6	5·15	11	12	8
November	51·5	·22	18	10	2
December	46·9	2·07	11	13	7
Total or mean	62·5	18·3	173	143	49

The following comparison of the number of cloudy days in Denver, Col., and El Paso, Texas, for eighteen months, taken from the Signal-Service reports, is offered for what it is worth, the length of time covered not being sufficient to give it great value:

Total number of cloudy days.

PERIOD.	Denver.	El Paso.
12 months, 1882	33	30
6 months ending June, 1883	36	17

Wishing to compare the monthly and annual mean temperature and the rain-fall of El Paso with those of Las Vegas Hot Springs, Denver, and San Diego, Cal., I have had recourse to some tables compiled from the Signal-Service records by Lieutenant W. A. Glassford, U. S. Army, which appear in a pamphlet entitled "Illustrated New Mexico," edited by W. G. Ritch, and published by the Bureau of Immigration at Santa Fé, N. M.:

Monthly and Annual Mean Temperature (Fahrenheit) of places named, being the mean of the observations of several years.

	Santa Fé, N. M. (Las Vegas).	Denver, Col.	El Paso, Texas.	San Diego, Cal.
January	28·2	27·1	46·9	53·7
February	31·7	33	50·6	54·4
March	39·1	39·4	57·4	55·5
April	45·5	46·3	64·6	57·8
May	56	56·9	73·3	61
June	65·4	67	81	64·2
July	68	72·1	81·8	67
August	65·9	70·5	78·6	68·7
September	59	60·7	72·8	66·5
October	49·4	50·2	64·3	63
November	36·7	35·5	50·5	58·2
December	30·2	30·4	46·3	55·4
Annual mean	47·9	49·2	63·4	60·4
Mean for winter months	30·0	30·1	47·9	54·5

Precipitation of Rain and Snow, in inches.

PLACE.	1875.	Average of several years, differing at the several places.
Santa Fé (Las Vegas)	16·65	13·89
Denver	15·24	14·57
El Paso (Fort Bliss)	9·56	11·90
San Diego	9·16	9·62
New York	43·24	43

In view of its mild winter climate, as shown by the foregoing tables, its altitude, the great dryness of the atmosphere and soil, and the remarkable preponderance of clear and fair days, especially during the winter and spring months, I think it must be conceded that El Paso presents many of the requisites of a winter resort for persons suffering from pulmonary complaints. Nor is this merely a theoretical conclusion. It is confirmed by the experience of a considerable number of asthmatic, bronchitic, and phthisical patients who have already tested the virtues of this climate. Some of these I met myself during a stay of some weeks last February and March, and with regard to others I was informed by the physicians of the place and the army officers at Fort Bliss. The testimony was the same that is usually obtained at such places—viz., that the patient soon began to lose his cough, to improve in appetite, and to gain in weight and strength.

Notwithstanding the newness of the place, the accommodations of El Paso are very fair. There are several quite large and respectable hotels, there is a good market, and the price of living is not high. Although in Texas, it is a very wide-awake Yankee town, or rather a cosmopolitan town, with an elegant court-house, public-school building, numerous churches, etc. One great charm to the visitor or sojourner is the proximity of old Mexico, just across the Rio Grande, where, within an easy walk or drive, he finds the city of Paso del Norte, surrounded by a well-irrigated and cultivated country, teeming with a kindly and industrious population. For myself, I never wearied of watching their strange seventeenth-century methods of living and working.

El Paso is best reached by way of the Atchison, Topeka, and Santa Fé Railroad from Kansas City. It offers to young men especially one inducement belonging to but few health resorts, and that is a reasonable probability of securing employment, inasmuch as it is a growing business place and not overrun with invalids.

Paper.

SOUTHERN PINES PARK; A NEW WINTER HEALTH RESORT.

By A. N. BELL, A. M., M. D.

IN August last, at the request of the proprietors, I examined a plot of eight hundred acres of pine woods in about the center of the State of North Carolina, which had been selected with a view to a winter health resort.

It is situated in Moore County, immediately on the line of the Raleigh and Augusta Railroad, sixty-eight miles south of Raleigh, midway between the Pedee and Cape Fear Rivers, on the summit of an extensive sandy elevation six hundred feet above the level of the sea, covered with pine forest, and known heretofore as "Shaw's Ridge." Latitude about 30° 12′ north, longitude 79° 21′ west.

Thermometrical observations taken at Manly for one year—December, 1881, to November, 1882—by Dr. G. H. Saddleson, show the mean temperatures as follows: Winter, 48°; spring, 61°; summer, 79°; autumn, 62°; annual, 62·5°. For eastern North Carolina the average temperature for a series of years is given: For winter, 46°; summer, 80°; annual mean, 69°.

The average rain-fall in this region is about forty-four inches. The snow-fall is rare and slight. As observed by Dr. Saddleson during the unusually severe winter of 1883–'84, there was but a single fall of three inches that lasted but two days.

The sandy and porous nature of the soil, undulating surface, and thrifty pine growth, all contribute to an unusual dryness of the surface and, relatively, of the atmosphere. Of the actual humidity of the atmosphere, no observations have been recorded in this neighborhood. But the indications are all favorable to an unusual degree of dryness for a forest atmosphere.

The pine forest region of North Carolina, in the midst of which this proposed park is situated, begins about fifty miles from the seacoast, extends the whole length of the State, and near the middle rises to an elevation of about six hundred feet above the level of the sea. As the elevation increases beyond the middle of the State, the pine forest gradually loses its identity by merging into mixed growth, and is finally almost lost in a great variety of deciduous trees.

This region in particular has long been distinguished for remarka-

ble healthfulness. In Professor Francis A. Walker's charts, "U. S. Census Reports, 1870," showing the ratio of deaths from consumption to ten thousand deaths from all causes throughout the United States, in this region the estimate is from two hundred and fifty to nine hundred, the smaller number being limited to a comparatively small area, comprehending the most exclusive portion of the pine forest highlands.

Considering the special advantages of this well-chosen place, as already pointed out, it unquestionably holds a favorable relation to the very best ascertained results of mortality statistics from consumption anywhere to be found in the State, if not indeed to any elsewhere. It is equally free from malarial diseases, and, for manifest reasons, it is almost wholly devoid of the conditions which favor them.

In addition to the sandy nature of the soil and the character of the forest growth, the undulations of the surface, and two considerable brooks, which are said to be annually living, even during the most extreme droughts, greatly add to the natural facilities for conversion into a beautiful and healthful park.

The plot is crossed near the middle, north and south, by the Seaboard Air-line Railroad. The eastern side from the railroad gradually ascends to the border, where it reaches an altitude of about fifty feet. From the top of this hill an abundance of pure spring water can be obtained at a depth of forty feet, from which, by windmill or other power, it can be raised to a surface reservoir with sufficient elevation to supply all the requirements of the lower ground to the west.

On the west side from the railroad crossing the descent continues for about one hundred rods until a beautifully clear brook, with clean white sandy banks and bottom, is reached. In a central and convenient place with regard to the surroundings this brook forms a considerable basin, which, with comparatively little labor, may be converted into a swimming bath, or even into a small boating lake, with a constantly running supply and overflow. And, anon, if used wholly or in part for a bathing basin, it may be shielded from view by flowering hedges and trellised vines.

Crossing this stream, there is a comparatively abrupt ascent for about forty rods to the top of a ridge, upward of thirty feet high, which gently descends on the other side to a second brook of about equal magnitude and beauty to the one already described.

Both of these brooks take their rise from springs in higher ground on the south side, where either one, or both, if required, can be partly intercepted and utilized for an abundant pure water-supply for the

western section, distributed through pipes to every cottage, displayed in fountains, and the overflow turned to account for flushing sewers and drains, descending northerly with complete removal of all wastes and avoidance of every possible source of soil pollution.

Dr. G. H. Saddleson, who has resided in Manly for several years, having gone there from Lockport, N. Y., when he was well nigh *in extremis* from pulmonary consumption and in despair, and, as he expressed himself to me, "had ceased to think he would ever be well enough to do any work again," has now regained such a measure of good health and working ability that "he really begins to think of entire recovery." He writes:

"The soil of this region is of clear sand of a great depth, forming a layer over this country on the summit of Shaw's Ridge to the depth of over ninety feet; it does away with surface dampness, except when the rain is falling.

"The drainage is perfect, for, aside from what the soil absorbs of itself, the surplus is easily carried off, this being an elevation with a descent on both sides. It is a water-shed between two streams.

"It would seem and is true that while there are decided curative properties in a region clothed with long-leafed pine, yet there is a drawback in the fact that nearly all sections in which that species of pine abounds are of but small elevation above the sea-level, and many districts are traversed by large streams with low banks; therefore it is desirable to seek a place where the yellow pine is found on elevated ground, also away from streams or large bodies of water. Yet too great elevation is to be avoided as well as entire absence from water.

"While this place has superior advantages in the way of drainage and absorption of surface moisture, yet the water-supply is abundant and of the purest quality. In the small valleys are springs of the purest water issuing forth as clear as crystal, the great depth of sand through which they pass acting as a perfect filter, removing all deleterious matter. These springs unite to form brooks. Two of these of good size are found in the park.

"The vegetable growth is much more luxuriant along these little streams than elsewhere, and goes to add much to its beauty.

"Among the attractions of the place, especially those that can be used as accessory to the cure of disease, may be mentioned:

"Carriage roads, which are of the best kind, being always dry, free from mud, and good throughout the year.

"The manufacture of turpentine and resin will undoubtedly prove of great interest to most persons who may come here; and, while of interest, it will be beneficial in a certain way, as many have received great benefit from breathing the fumes of the hot resin as it comes from the distillery. Many turpentine distillers will be found in the immediate neighborhood,

and the stiller generally takes much pride in showing the visitor the intricacies of the process.

"The famous Jackson Springs are within a few miles, and a short carriage drive will take one to this romantic locality. The waters are valued especially in the treatment of dyspepsia and allied diseases. Another half-hour's drive over a smooth but winding road, bordered on either side of its entire length by the tall, majestic long-leaf pines, brings one to a very curious geological formation, known as Paint Hill. Here is found an unaccountable upheaval of marl-bed, quite interesting, where can be gathered many curious specimens of small but rare fossils. In the valley below, quantities of petrified wood are found.

"In different places in the forest can also be found what is termed ferruginous wood—that is, wood that has been converted into iron, showing plainly the grain, and even knots as they existed in the original tree.

"Returning to the park by another route, Forest View falls upon the sight, a prominent eminence commanding extensive views.

"Within about five miles the new industry of silk culture has just begun. A large farm is devoted to the purpose. Here can be seen the interesting process of making raw silk.

"Among the trees and flowers indigenous to the localitywhich would prove of interest, especially to the Northern invalid, who would forget his infirmity in his admiration of them, would be first and most constantly what he could not avoid seeing—the long-leaf pines. The persimmon-trees would also attract marked attention, from being frequently studded with bunches of mistletoe; the black gum, the sweet gum, the non-poisonous dogwood. the beautiful, symmetrical tulip-tree, straight as an arrow, the sweet bay, and the beautiful evergreen holly, with its conspicuous scarlet-red berries.

"If the lover of Nature's beauties remains at the proper season, he will find flowers—such as the sweet, delicate trailing arbutus, the wonderful trumpet lily, the curious frog's bonnet, the wild honeysuckle, laurel, and many others."

In this description of trees, flowers, and other growths, Dr. Saddleson has omitted to mention the thriftiness of the grape-vine, and particularly the Scuppernong, which is admirably adapted to the formation of extensive fruit-bearing arbors and trellises, the magnificent flowering shrubs—oleanders and crape myrtles—frequently growing to the height of from fifteen to twenty feet, and completely covered with flowers; the profusion of azaleas and many other native flowering plants, filling the woods and bordering the by-ways with beauty and sweet-smelling odors, a mere catalogue of which would fill several pages.

Assuming this area of eight hundred acres sufficiently cleared, laid out in drives and foot-paths, ornamented with plants indigenous

or naturalized to the climate, under the skill of an accomplished landscape engineer; the springs and brooks utilized into a plenary water-supply for all purposes, as free as air, in the promotion of health, comfort, and luxury; drainage and sewerage effected in the most perfect manner; by contemporary work to these ends from the very beginning of the improvement, I find it difficult to conceive of any other place which so eminently comprehends all of the most desirable conditions for the promotion of the purpose in view—the establishment of a genuine winter health resort.

The work of improvement has already begun. The ground is being cleared, six cottages have been erected, and fourteen others have been contracted for.

A hotel with central accommodation for fifty guests, with pavilion extensions, with as many suites of from two to four rooms each, for the accommodation of invalids and families with invalids, who appreciate the desirability of such separation, is in contemplation, and will be proceeded with so soon as the prospect justifies it.

With the ample space and exceedingly eligible sites at command, cottage sites are now offered, and buildings thereon to order, for sale or lease. But all are restricted to sanitary supervision under the direction of the company, which binds itself to a controlling interest.

For those who wish to attend religious services, Methodist, Presbyterian, and Baptist churches are in the vicinity.

Finally, with regard to accessibility. At the time of my visit I left New York by the four o'clock express train for Baltimore. On arrival at Baltimore, about nine o'clock, took passage by the Bay boat, which runs in connection with that train, for Norfolk. After supper, a good night's sleep, and breakfast, of quality, comfort, and elegance unsurpassed by any steamboat line with which I am acquainted, arrived at Norfolk—first touching at Old Point Comfort—about ten o'clock the next morning; thence by the seaboard Air-line Railroad to the place of destination, without change, arrived at midnight, thirty-two hours from New York. The time was extended, however, by long stops at Weldon, Kittrell's, and some other places, to take a look by the way. The regular time from New York, by the same route, is about twenty-eight hours; from Boston, thirty-five hours; from Philadelphia, twenty-five hours; and from Baltimore, twenty-one hours, without breaking rest in any case, the night being spent on board the steamer. From Boston and New York steamship may be taken direct to Norfolk, if preferred, connecting there with the same train as if by way of Baltimore.

Business Meeting.

Minutes of the meeting for private business, 2 P. M., Tuesday, May 11, 1886:

The association met for the transaction of its private business.

The President, Dr. William Pepper, in the chair.

The minutes of the last stated meeting were read and adopted.

Dr. P. H. Kretzschmar, of Brooklyn, announced the death since our last meeting of one of our members, Dr. Samuel G. Armor, of Brooklyn, who died October 29, 1885. Dr. Kretzschmar referred to the excellent character of our deceased colleague, as a physician and man, and expressed the hope that his memory may live among us for many years.

The association proceeded to an election of officers for the ensuing year, and, as the nominating committee had presented but one name for each office, it was unanimously resolved that the secretary cast a ballot for the ticket as nominated, resulting in the election of the following:

President—Dr. Frank Donaldson, Sr., Baltimore.

Vice-Presidents—Dr. V. Y. Bowditch, Boston; Dr. R. G. Curtin, Philadelphia.

Secretary and Treasurer—Dr. J. B. Walker, Philadelphia.

Member of Council—Dr. F. C. Shattuck, Boston.

On motion, the time and place of next meeting were left with the council. Dr. Van Bibber invited the association to hold its next session in Baltimore.

A communication was received from the Surgical Association, through Dr. J. Ewing Mears, inviting our organization to join with a number of other special societies in forming a congress to be styled "The Congress of American Physicians and Surgeons." The same communication submitted a plan, and requested that we send a committee of five to meet similar committees from the other associations to consider the matter.

On motion of Dr. Loomis, the president appointed the following a committee, with power to act in the premises, as necessary to carry out the objects of the congress:

Drs. Loomis, Donaldson, Sr., Shattuck, Bruen, and W. W. Johnston.

Dr. Kretzschmar proposed the following amendment to the constitution:

Resolved, That any member of the association absent from the meetings for three consecutive years without sufficient cause may be dropped from the list of members by vote of the council.

Dr. Bosworth moved that the committee of arrangements of next meeting be directed to provide for a dinner to take place on the evening of the last day of the meeting, the expenses of which shall be borne *pro rata* by each member participating. Carried.

On motion, the "The New York Medical Journal" was given the

publication of all papers read before the association, subject to conditions for publication of a volume of transactions, as made for last year.

On motion of Dr. Kretzschmar, the secretary was directed to note in the minutes the members present at each annual meeting.

The council reported the following recommendations to membership:

Drs. Frank Donaldson, Jr., Baltimore; J. H. Musser, Philadelphia; G. R. Butler, Brooklyn; W. Matthews, U. S. A.; and A. S. Garnett, Hot Springs, who were thereupon elected members of the association.

On motion, the secretary was instructed to have published in pamphlet form the constitution and by-laws of the association, together with a list of members.

A communication was read from "The College of Physicians of Philadelphia," tendering to the association the use of the lecture-room in which our meetings were being held without charge, and also tendering the courtesies of the college to the members of the association during their sojourn in the city.

On motion, the courtesies were acknowledged, and a vote of thanks for the same was unanimously adopted, and ordered to be forwarded.

On motion, Dr. C. C. Rice, of New York, was appointed chairman of a Committee on Mineral Springs, with power to choose his own associates on committee, and requested to present a report at our next annual meeting.

Then adjourned. J. B. Walker, *Secretary.*

Paper.

MITRAL STENOSIS. CASES AND REMARKS.

By GLENTWORTH R. BUTLER, M. D.

THE object of this brief and hastily prepared paper is to record fourteen cases of mitral stenosis, and thereby make a small addition to the existing statistics of this form of cardiac lesion. The cases here given were treated in the Department of Diseases of the Thoracic Viscera in St. Mary's General Hospital, of Brooklyn, N. Y. The clinical examinations and therapeutic measures were conducted by Dr. B. F. Westbrook, Dr. I. H. Platt, and the writer.

Case I.—Male, aged forty. So far as ascertained, this patient had suffered from acute rheumatism but once—about one year before admission. When admitted he was suffering from dyspnœa. He also complained of gastric and bronchial symptoms. There had been no hæmoptysis. Œdema of the lower extremities was present to a slight degree. Physical examination showed some cardiac hypertrophy. A blowing systolic murmur was heard over the anterior cardiac space, propagated

into the axilla, but not heard posteriorly. Over the apex, between the nipple and the sternum, was also heard a presystolic vibratory murmur. The pulmonary second sound was markedly accentuated. Under treatment, comprising tonics and digitalis, this patient improved greatly and was discharged, the murmur persisting.

Case II.—Female, aged forty-four. This case was also preceded by acute rheumatism nine years previous to admission. There were some gastric symptoms, but neither dyspnœa nor hæmoptysis. The record of the physical examination is imperfect, simply mentioning the presence of a presystolic murmur. Improvement was rapid under a simple tonic treatment.

Case III.—Female, aged forty-four. This case gave a history of several attacks of acute rheumatism. When admitted to the hospital she presented symptoms of melancholia. In the course of examination a presystolic apical murmur was discovered, of moderately blubbering character, between the nipple and sternum. There was no cardiac hypertrophy, and no fremitus on palpation. Œdema of the lower extremities was absent, and dyspnœa was very slight. This case improved under treatment directed to the betterment of the general health, the murmur persisting.

Case IV.—Female, aged thirty. No history of rheumatism could be elicited. There had been no hæmoptysis. Dyspnœa was manifest. Slight œdema of the lower extremities was present. The pulse was soft and compressible. Physical examination showed the apex-beat in the fifth interspace, one inch to the left of the nipple. There was a slight thrill with the apex-beat. To the left of the sternum and toward the apex the first sound was very loud and preceded by a harsh murmur. The second sound of the heart was feeble and accompanied by a bellows murmur. The urine contained, by volume, one eighth albumin and granular casts. This case had a fatal termination, and the autopsy showed, in addition to considerable hypertrophy, aortic stenosis and incompetence. The vela of the mitral valve were agglutinated, forming a funnel-shaped opening.

Case V.—Male, aged twenty-eight. He gave the usual history of rheumatism. Dyspnœa existed, but no œdema. The pulse was notably small, but not irregular. Physical examination showed the apex-beat half an inch to the left of the nipple in the fifth interspace. There was no fremitus. The pulmonary and aortic second sounds were apparently normal. There was a presystolic murmur at the apex over a space two and a half inches in diameter. This bruit was soft in quality and did not possess the blubbering quality. The patient improved rapidly under a tonic regimen, the bruit still persisting.

Case VI.—Female, aged thirty. This patient presented on examination an apex-beat in the fifth interspace in the mammillary line. A masked vibratory fremitus accompanied the action of the heart. On auscultation, a strong, harsh, blubbering, presystolic murmur was audible. Otherwise the cardiac sounds were apparently normal. The symp-

toms for which she was admitted—slight dyspnœa, palpitation, and general weakness—were distinctly due to overwork. They yielded quickly to rest in bed, with little medication.

Case VII.—Male, aged twelve. This patient had a history of three previous attacks of rheumatism. He complained of slight cough and considerable cardiac pain. There was some œdema of the lower extremities. Physical examination showed a marked retraction of the chest-wall with the systole of the heart. The apex-beat was two inches to the outside of the nipple, in the sixth interspace. There was an accentuated closure of the pulmonary valve. Over the middle sternum was a faint diastolic murmur. At the apex there was a marked systolic murmur and a somewhat fainter presystolic bruit. This patient improved under the use of iron and digitalis, the murmurs persisting.

Case VIII.—Male, aged thirty-five. This patient had suffered from rheumatism and endocarditis five years previous to admission. When admitted, dyspnœa and cyanosis were prominent symptoms. There was marked œdema of the lower extremities, extending upward to the middle of the thigh. The pulse was very rapid, feeble, and irregular. The jugulars were swollen and pulsating. The heart was dilated. Epigastric pulsation was well marked. The apex-beat was in the fifth interspace beyond the nipple. A systolic bruit was heard at the apex and transmitted into the axilla. The aortic second sound was inaudible. The pulmonary second sound was accentuated. There was no albumin in the urine. Mitral stenosis was diagnosticated from the pulse, the accented closure of the pulmonary valves, and the turgescence of the venous system. The patient was practically moribund. As a last resort, and to relieve the venous side of the circulation, the right auricle was aspirated by Dr. B. F. Westbrook, and eighteen ounces of blood were withdrawn, with marked but temporary relief. At the autopsy nineteen ounces of blood were found in the pericardial cavity, and blood could be made to ooze from the needle puncture by pressure on the heart. The operation was evidently done at so late a date that the cardiac muscle had lost its tonicity and power of contraction, thus preventing the closure of the aspirator puncture. In addition to mitral incompetence, the autopsy showed a marked mitral stenosis, the orifice admitting only the tip of the middle finger. The lungs were œdematous, and there was considerable fluid in the abdominal and thoracic cavities.

Case IX.—Female, aged forty-six. Scarlatina appeared to be the only precedent disease in this case. Cardiac palpitation and dyspnœa, not excessive, were the subjects of complaint. There was very slight œdema of the lower extremities. The pulse was small and rapid. Physical examination showed the apex in the fifth interspace, half an inch outside of the nipple. The pulmonary second sound was loud but not sharp. At the apex and just above there was a rough presystolic murmur. In this case the fluid extract of cactus grandiflora acted very effectively, and improvement was rapid, the murmur still existing.

Case X.—Male, aged seventeen. This patient gave a history of rheumatism four years before admission. He was admitted for the relief of a traumatic ulcer, which healed promptly. A lobular pneumonia then developed, from which he became fairly convalescent. Some cardiac symptoms were then manifested for the first time in his history. Physical examination showed the apex-beat moved to the left and below the nipple, with notable bulging of the præcordial space, and a marked pulsation extending over a large area in the same region. A to-and-fro murmur was heard at the base over the aortic valves, and an apical systolic murmur, all three well marked. In addition, a faint presystolic bruit was audible over the area of mitral obstructive murmurs. The case had a fatal termination, and the autopsy disclosed great dilatation of the left ventricle, and a similar condition of the left auricle. The aortic orifice was stenosed and the valves incompetent. The vela of the mitral valve were thickened and adherent, making a funnel-shaped contraction. They were also incompetent.

Case XI.—Female, aged thirty. In this case extensive œdema existed. Vomiting and cough were prominent symptoms. The urine was lessened in quantity and contained considerable albumin. Physical examination showed turgescence and strong pulsation of the jugulars. A diastolic murmur was heard along the right border of the sternum, replacing the aortic second sound. The pulmonary second sound was accentuated. A systolic murmur was audible at the apex, transmitted to the spine posteriorly. Above the apex, just internal to the nipple, was a presystolic murmur of rough quality. There was also a marked pulsation one inch to the left of the sternum, on a level with the nipple, and a systolic murmur was audible in this situation. The autopsy revealed incompetence of the aortic valve. The mitral leaflets were adherent, forming a buttonhole contraction which barely admitted the tip of the finger. The mitral valve was also incompetent. The pulmonic orifice showed a marked degree of stenosis.

Case XII.—Female, aged seventeen. This patient gave a history of rheumatism two years before admission. Vomiting, œdema of the feet, and intercostal neuralgia were the prominent symptoms. There had been no hæmoptysis and no dyspnœa. Physical examination revealed a systolic murmur at the apex, transmitted to the spine posteriorly, and a presystolic bruit of rough quality. The symptoms were soon relieved by rest and a simple tonic regimen, the murmurs still persisting.

Case XIII.—Male, aged twenty-eight. He gave a history of repeated rheumatic attacks since childhood. Dyspnœa and hæmoptysis had been prominent events in the history. When admitted there was marked œdema of the lower extremities and excessive dyspnœa. He was placed on the use of fluid extract of *Cactus grandiflora*, but within a day or two cyanosis developed, the jugulars became distended, and the pulse was very small, rapid, and irregular. The hand, laid lightly on the outer part of the right hypochondrium, revealed a slight but unmistakable pulsation of

the liver, with excessive tenderness of the latter viscus. The apex-beat was carried downward to the seventh interspace, two inches and a half to the outside of the nipple. A heaving impulse was visible and palpable over the entire præcordia. On auscultation, the sounds of the heart were so tumultuous that nothing could be ascertained with certainty beyond a faint systolic bruit at the apex and a stronger systolic murmur over the tricuspid area. The pulmonary second sound was accentuated, and the second cardiac sound could not be heard at or outside of the apex. This combination of signs was taken to indicate mitral stenosis with engorgement of the left auricle, lungs, and right heart, with consequent functional incompetence of the tricuspid valve. The therapeutic indications were fulfilled by the administration of calomel and saline cathartics, with free dry cupping over the liver. The fluid extract of digitalis was then substituted for the *Cactus grandiflora*. Immediate improvement was the result. Three days after this the physical signs had changed. The pulse had gained considerable regularity, and, instead of being notably small, possessed the characters of the "shot-pulse" of aortic regurgitation. The cyanosis had in a great measure disappeared, as had also the tenderness and pulsation of the liver. On auscultation, the systolic murmur over the tricuspid area was no longer perceptible. The mitral systolic murmur had gained in volume and intensity. Over the situation of the aortic valves a double bruit was plainly perceptible. There was no presystolic bruit. The fact of the right side of the heart having been unloaded, and the cardiac muscle having regained its tonus, fully accounted for the marked changes in the physical signs. The patient apparently continued to improve for a week or ten days, but died suddenly after an unusual exertion. The autopsy revealed a heart weighing thirty-six ounces. The aortic valves were thickened and incompetent, and the aortic orifice was dilated. The mitral leaflets were thickened and adherent, forming a funnel-shaped contraction, admitting one finger, and were also incompetent. The tricuspid orifice was more patulous than normal.

Case XIV.—Female, aged twenty-seven. This patient had been subjected to several attacks of acute rheumatism. She was admitted during an exacerbation of this affection. The joint symptoms were promptly controlled by the use of sodium salicylate. Gastric catarrh, vomiting, and bronchitis were more prominent and troublesome than the articular disease. After having been some days in the ward, a condition of moderate cyanosis developed, and the jugulars became distended. Examination showed a weak and very small pulse. The apex-beat was in the fifth interspace in the mammillary line. The pulmonic second sound was notably accentuated, and at the left of the sternum, from the third cartilage upward, was a soft blowing murmur, probably functional. At the apex a systolic murmur was audible, transmitted into the axilla. The second sound was not heard at the apex. Marked tenderness and some swelling over the right hypochondrium existed, but no hepatic pulsation could be

perceived. The first sound of the heart was feeble and lacking in the muscular element. This combination of signs and symptoms was taken as indicating an engorged condition of the right side of the heart due to mitral stenosis, regurgitation, and loss of cardiac tonus. The character of the pulse, the filling of the jugulars, the absence of the first sound at the apex, and the hepatic congestion, constituted the data for assuming the existence of mitral stenosis in the absence of a presystolic murmur. The patient was apparently moribund, and the necessity of unloading the right chambers of the heart led to the application of wet cups over the liver, and the abstraction, in two cuppings, of sixteen ounces of blood. Concentrated solutions of a saline cathartic were also exhibited. As soon as these measures had taken effect, digitalis, strychnine, and ammonia were given. The results were eminently gratifying, and the patient, after the lapse of six weeks, is in excellent condition and soon to be discharged.

In briefly analyzing these cases, it appears that eight occurred in females and six in males, 57 and 43 per cent. respectively. Only five cases were of uncomplicated mitral stenosis, and of these four were in females and one in a male, 80 and 20 per cent. respectively. In the uncomplicated cases, dyspnœa was not a prominent symptom, and œdema was absent or very slight. In the remaining cases, anasarca and ascites were accounted for either by the existence of other valvular lesions or by the presence of renal changes. The valvular complications in four cases consisted of mitral incompetence. In two cases aortic and mitral regurgitation co-existed, and in two aortic stenosis and incompetence with mitral incompetence. Aortic stenosis and incompetence in one case completes the list. Death occurred in five cases, and the remaining patients were discharged improved. In the five fatal cases autopsies were held, and in each instance corroborated the diagnosis founded upon the clinical evidence. In ten cases a rheumatic history existed. In one rheumatism was explicitly denied, one was referred to scarlatina, and in two the evidence was negative. In conclusion, it should be stated that, while no deductions should be drawn from so limited a number of cases, yet the analysis agrees in a general way with the results of more extensive investigations. I desire to call attention to the successful treatment in Cases XIII and XIV, and to express the opinion that, when the technique of cardicentesis has been improved and perfected, it will have an important, if small, field of usefulness in the treatment of some apparently hopeless conditions.

As this paper is intended to be a simple clinical record, no reference has been made to the recent admirable papers by Flint, Broadbent, and others.

Paper.

THE CAUSATION OF PNEUMONIA. ABSTRACT OF A PAPER.

By HENRY B. BAKER, M. D.

EMPLOYING the data collected in the office of the Michigan State Board of Health relative to the sickness from pneumonia and the coincident meteorological conditions in Michigan, more especially during the eight years 1877 to 1884, I find that certain meteorological conditions are so uniformly associated with sickness from pneumonia as to make it appear that they bear a causal relation to that disease.* The atmospheric condition which is most closely associated with pneumonia is the night ozone; but, although it is probably one factor, the manner in which it is associated does not indicate that it is always the controlling factor in the causation of pneumonia. And, besides, the amount of ozone is believed to be to a great extent controlled by the atmospheric temperature. Therefore I think ozone is not a primary cause. The velocity of the wind has rather close relations to the disease. Variations in atmospheric pressure appear to have some influence in the causation of pneumonia. Relative humidity of the atmosphere has apparent relations to the disease; but it also depends largely upon the atmospheric temperature. Absolute humidity of the air has very close relations to pneumonia, and in such manner as to indicate a causal relation. That condition of the air, however, is, so far as relates to out-door air, almost wholly controlled by the temperature. Finally, the curves

* *The nature and extent of some of the data used relative to sickness from pneumonia and meteorology in Michigan.*

YEAR.	Number of weekly reports of sickness used.	TEMPERATURE.			
		Number of stations.	Observations per day.	Number of days.	Number of observations.
1877.....	3,320	12	3	365	13,140
1878.....	3,221	14	3	365	15,330
1879.....	3,755	19	3	365	20,805
1880.....	3,991	15	3	366	16,470
1881.....	3,567	20	3	365	21,900
1882.....	4,745	22	3	365	24,090
1883.....	4,458	19	3	365	20,805
1884.....	3,957	20	3	366	21,960
Total, 8 years..	31,014	..	..	...	154,500

MEAN ALTITUDES AND RAINFALL IN PENNSYLVANIA.

To accompany a map of THE DISTRIBUTION OF PULMONARY PHTHISIS.

No. 2.

representing the average temperature uniformly bear a close relation to sickness from pneumonia (shown in Diagram No. 9), and the curves representing sickness follow uniformly at such period after the temperature curves as to make it seem certain that the sickness is, directly or indirectly, caused by comparatively low temperature. Though, for reasons stated near the close of this abstract, the statistics of sickness and coincident meteorological conditions gathered in Michigan are most to be relied upon, this conclusion, based upon those statistics, is re-enforced by other statistics which I present, covering 49,487 cases of sickness and 11,596 deaths from pneumonia in the armies of the United States during the three years (1862–'64) of the war of the rebellion, and the meteorological conditions at representative stations; also 114,119 deaths in London during the thirty years 1845–1874, and observations of temperature by months during the same period; also 6,073 cases of pneumonia among native troops and 4,215 cases among European troops in India, with temperature by months at six representative stations. These statistics, representing pneumonia in different parts of the United States, in England, and in India—that is to say, in several climates and under different conditions—confirm the conclusion that in any given place pneumonia is controlled by the atmospheric temperature.

So far, the result is only to prove in a scientific manner the truth of more or less wide-spread beliefs since the time of Hippocrates. This placing of the old hypothesis upon a scientific basis, however (although it will, as I believe, be accepted as a contribution to science), needs a further contribution to render it most acceptable; and that seems to be forthcoming. The difficulty in the way of accepting the hypothesis has been to understand *how* it is possible for cold to cause pneumonia. Thus, Professor Rindfleisch has said: "Even when, based upon some unequivocal observations, we have proclaimed the taking cold as the common cause (of croupous pneumonia), there has yet by this no insight been obtained into the process of taking cold. For what has the partial refrigeration of the outer skin to do with the inflammation of an interior organ?" * The key to this "insight," which Professor Rindfleisch has said is wanted, has for many years seemed to me to be the fact that the "refrigeration" is not so much of the "outer skin" (which is mostly covered with clothing) as it is of that inner skin—the mucous lining of the

* Page 423, "Text-book of Pathological Histology." By Dr. Edward Rindfleisch. Translated from the German by Drs. Kloman and F. T. Miles, Philadelphia, 1872.

lungs and air-passages, and which we are liable to forget is so extensive—amounting, as it does, according to Professor Dalton, to about 1,400 square feet of surface in an ordinary adult person.* We are also liable to forget that, which appears to be true, the regulation of body temperature is, partially at least, by means of the lungs. Holding these facts in mind, and also the further facts that the surfaces of the air-cells and air-passages are constantly moist, and that the air when exhaled is probably saturated with vapor of water, and at a temperature of about 98° F., we realize that there is constantly being taken out of the body from the air-passages and from the air-cells in the lungs a considerable amount of vapor of water. The quantity which *enters* the lungs with the air inhaled differs greatly according as the air is or is not saturated with vapor, and also according to the temperature at which the air is breathed.

The Influence of Temperature, Humidity, etc., on the Quantity of Vapor of Water eliminated from the Lungs and Air-passages.—At ordinary temperatures, the capacity of air to retain moisture varies somewhat regularly with its temperature. The higher the temperature, the greater the amount of vapor of water it can contain; thus, according to Professor Guyot's tables, based upon experiments by Regnault, a cubic foot of air at the temperature of zero F., if saturated with vapor of water, contains 0·5 Troy grains; at the freezing-point it contains 2 grains; at 70° F. it contains 8 grains; at 98° F. it contains 18·69 grains.† Thus it appears that the "absolute humidity" of the atmosphere is controlled, as to its maximum, by the temperature of the air. (The "relative humidity" is the per cent. of saturation of the air with vapor of water; and as we have seen that at 100 per cent., or when totally saturated, the quantity varies with the temperature, it follows that any given per cent. of "relative humidity" relates to a different quantity for every different degree of temperature; thus 50 per cent. of saturation at the temperature of 32° F. shows the presence of one grain of vapor of water in each cubic foot of air, while at 70° F. it shows the presence of 4 grains, etc., these being 50 per cent. of the quantities mentioned above as in air completely saturated with vapor of water.)

Starting with the fact that the normal temperature of the human body is 98·5° F., and the fact that the air exhaled has been in contact with the air-passages and is mixed with air from the air-cells in the lungs, we may safely assume that whatever its temperature when in-

* Dalton's "Phys."

† "Smithsonian Meteorological and Physical Tables," Guyot, page 93, B.

haled, the temperature of the air when exhaled will not be much different from the temperature of the body, and that it will probably not be very different at different seasons of the year.

The air when exhaled has been in constant contact with moist surfaces throughout its passage into and out from the lungs; it is therefore probably nearly saturated with vapor of water.

Assuming the air exhaled has uniformly a temperature of 98° F., and that it is saturated with vapor of water, each cubic foot of air exhaled contains, according to Guyot's tables, 18·69 grains of water; assuming 18 respirations per minute, of twenty cubic inches of air each, there will be exhaled daily 11·68 Troy ounces of water in the form of vapor. This is not as much by four or five ounces as is stated by some physiologists; but it is convenient to have a standard arrived at by the same means as those with which we must deal in studying the influence of meteorological conditions, so I continue to employ this method and standard.

The absolute grains of vapor in the atmosphere at any given time are ascertained by means of the wet-bulb and dry-bulb thermometers. Assuming that there are three hundred cubic feet of air breathed in a day, and knowing the absolute grains of vapor of water in a cubic foot of air at the temperature which prevailed on that day, the product of these two gives the number of grains of vapor inhaled in a day, which, subtracted from the amount exhaled, gives the excess of moisture exhaled over that inhaled. Cold air is always dry air; and whenever air is warmed, as it is in the lungs, its capacity to retain vapor of water is increased, and its demand for water is very great; it, therefore, constantly takes vapor of water from the lungs.

It may thus be seen that when warm air saturated with vapor of water is inhaled, one effect is to lessen the passage of fluids from the blood into the air-cells and air-passages; when, on the other hand, the air inhaled is cold and therefore dry, an increased quantity of fluids must pass from the blood into the air-cells and air-passages in order to keep them in the normal moist condition. The fluid which constantly passes from the blood-vessels into the air-cells and air-passages contains some of the salts of the blood; and such as are volatile pass out of the body with the vapor of water exhaled at every breath; but such salts as chloride of sodium will not readily pass off with vapor of water, the usual mode of preparing salt from the brine being by the evaporation of the water and the collection of the salt which remains. For many years it has been known that chloride of sodium, which is found in the urine of healthy persons, is absent dur-

ing the onward progress of pneumonia, and reappears in the urine when the patient is convalescing. For several years I tried to secure such analyses of lungs of persons dead from undoubted pneumonia, and comparisons with lungs of persons who did not have pneumonia, and such other comparative analyses as would show whether or not it was, as I supposed, that during the onward progress of pneumonia the chloride of sodium passed from the blood into the air-cells, and accumulated there because it did not so rapidly pass off as did the vapor of water. However, we are not left to conjecture as to the course which chloride of sodium takes when during the onward progress of pneumonia it disappears from the urine. In vol. xxxv of the "Transactions of the Royal Medical and Chirurgical Society of London," published in 1852, is a paper by Lionel Smith Beale wherein he shows by such analyses as those I have outlined, showing the chemical composition of the sputa and of the lungs, that the chlorides, which during pneumonia disappear from the urine, do appear in the sputa and in the air-cells of the lungs at such times.

At such times as pneumonia is most caused there is, then, as shown by the data which I have collected, an unusual demand upon the air-cells for fluids; their function in this respect is unusually taxed. Passing into the air-cells with the fluids are certain salts which do not pass out with the vapor, but accumulate in the air-cells. This is shown by *a priori* evidence, and also by the analyses by Dr. Beale. The salt which accumulates is an irritant. It has been held that the extraordinary stimulation of an ordinary function of an organ or part of the body leads to the congestion, and even to inflammation, of that part. If this be accepted, the causation of pneumonia is now, perhaps, sufficiently shown.

There are, however, certain facts concerning pneumonia which to my mind can now be more fully explained than is done by the foregoing facts and considerations. One prominent fact in the pathology of pneumonia is that the fibrinous exudate in the air-cells is sometimes a principal source of danger. In quantity of fibrinous material exuded pneumonia appears exceptional. What is the explanation of this fibrinous deposit? Changes in blood-pressure do not seem to fully account for it. Diagram No. 21 shows, however, that the average daily *range* of the barometer has such close relations to pneumonia as to indicate a possible causal relation. I regret that I could only include the observations for three years, and they do not seem to be sufficient to make a steady curve.

It may be noted in passing that in albuminuria there is, as in

pneumonia, an exudation of unformed material which is not subsequently organized. Speaking of the diseases most associated with pneumonia, Dr. Sturges says: "Thus it will be seen from the appendix that renal disease figures largely among the pre-existing morbid conditions of the individuals enumerated." * He also says: "It appears upon calculation that pneumonia in kidney disease is most frequent in the so-called amyloid or waxy degeneration. According to Dr. Dickinson, the marked tendency to inflammation which characterizes this change is seen most conspicuously in the lungs, and next most often in the pleura." †

I have shown how, through the inhalation of cold, dry air, the exudation of fluids into the air-cells of the lungs is increased; and how, by the unusual evaporation of that fluid, an unusual quantity of chloride of sodium accumulates in the air-cells. It remains to point out how, through the influence of that chloride of sodium in the air-cells, the exudation into them of the albuminous constituents of the blood-serum is probably favored. Perhaps this may be best shown by a quotation from a standard text-book on physiology as follows: "But a substance like albumin, which will not pass out by exosmosis toward pure water, may traverse a membrane which is in contact with a solution of salt. This has been shown to be the case with the shell-membrane of the fowl's egg, which, if immersed in a watery solution containing from three to four per cent. of sodium chloride, will allow the escape of a small proportion of albumin. Furthermore, if a mixed solution of albumin and salt be placed in a dialyzing apparatus, the salt alone will at first pass outward, leaving the albumin; but after the exterior liquid has become perceptibly saline, the albumin also begins to pass in appreciable quantity." ‡

It seems significant that the two organs in which an albuminous exudation occurs so markedly as in the kidneys and in the lungs should both be so constituted as that these facts relative to the exosmosis of albuminous substances should be applicable, because chloride of sodium is normally excreted by the kidneys, and, as it passes by osmosis with extreme facility, the first beginnings of the urine in the Malpighian bodies would naturally be saline, so that when the blood is unusually saline, the urine in the uriniferous tubules may be

* "Natural History and Relations of Pneumonia," Octavius Sturges, M. D. F. R. C. P., London, 1876, p. 81.

† Page 82, "Nat. Hist. Pneumonia," Sturges.

‡ "Treatise on Human Physiology, for Use of Students and Practitioners," John C. Dalton, M. D., sixth edition, Philadelphia, 1875, p. 363.

sufficiently saline to induce the exosmosis of albumin from the blood-vessels into the urine. But, while this may occur in the kidney, one condition seems to make it much more probable in the lungs; because in the lungs, through the constant evaporation of the fluids exuded, the salinity of the remaining portion is constantly increased. Is it any wonder, then, that under the continuation of unusual evaporation there sometimes comes a time when the albuminous exudation fills a large proportion of the air-cells?

Whether or not the ultimate fibrinous character of the exudate in the lungs is due to the blood-plaques,* or is a result of the oxidation of the albumin, otherwise induced, I will not in this abstract stop to discuss further than to refer, in this connection, to the fact that fibrinous casts are formed in the kidney; and also, with reference to oxidation, refer to the diagrams which show such close relations between pneumonia and atmospheric ozone.

An albuminous or a fibrinous exudate is a favorable situation for the reproduction of micro-organisms. Whether or not in pneumonia there are uniformly such low organisms as the "pneumococcus" of Friedländer, the statistics which I present show that the causation of the disease is absolutely controlled by the meteorological conditions. The fact that one attack does not protect from another is evidence against its being a specific disease, while the fact that persons who have had pneumonia are more likely to have it again † is also more favorable to its causation in the manner I have pointed out.

The Kind of Pneumonia treated of in this Paper. — Among physicians there seems to be a belief that different forms of pneumonia have different causes, while among statisticians there is a strong belief that nearly all acute affections of the air-passages are more or less controlled by similar meteorological conditions. Thus Professor Germain Sée ‡ disbelieves the thirty-years statistics in London, compiled by Buchan and Mitchell, because they show that the curves for pneumonia and bronchitis are similar. To me it seems quite possible that inflammation of one portion of the lining of the air-passages may have the same cause as an inflammation of a contiguous portion. Also that the character of that inflammation may be modified by the condition of the patient. The weekly reports of sickness in Michigan do not usually specify croupous pneumonia; the printed blank reads simply "pneumonia." The cases of sickness in the United States Army are reported, or at least pub-

* Bizzozero, Hayem, Eberth, Osler, and others. † Sturges.

‡ Page 73, "Diseases of the Lungs," William Wood & Co., New York, 1885.

lished, as from "pneumonia." The same is true of all the statistics of pneumonia. Therefore the kind of pneumonia treated of in this paper is the usual kind, the most common kind. Furthermore, there is, in the data which I present, proof that it is all, or nearly all, of one kind, statistically and causally. Otherwise it could not have absolutely quantitative relations to the temperature of the air inhaled. That it has such relations is graphically shown in Diagram No. 9.* My belief is that the reason why that diagram shows smoother curves than some of the others is because the details of the observations and reports were more accurately attended to. The meteorological observers were supplied with standard thermometers, the stations were representative of the area in which the sickness was, the reports of sickness were made weekly by leading physicians in active practice, and the compilation has been done with very great care to learn the exact truth. My own view is that the truth has been reached, and that it is exhibited in Diagram No. 9 of the series which I present to you.

I respectfully submit that the importance of the subject warrants a full investigation.

Whenever the views here presented shall have been accepted, numerous questions are at once pertinent—as to the diet most favorable to keeping the blood in the condition to best resist the tendency to pneumonia; as to the best methods of treatment of the person sick with pneumonia, whether by warm moist air, etc.; and especially as to how best to control the condition of the air inhaled by persons generally, as to lessen the danger of their contracting the disease. One lesson in this regard seems obvious, namely, the importance of securing proper moistening of all air which requires to be warmed, in houses, offices, public buildings, and wherever such conditions of the air inhaled can be controlled.

* A series of thirty-two diagrams were presented to each member of the society present at the Philadelphia meeting. The diagrams are not printed with this abstract.

Paper.

CONSUMPTION AMONG THE INDIANS.

By WASHINGTON MATTHEWS, M. D.

THE subject of consumption among our North American aborigines presents some interesting problems to the climatologist.

We have permanently established on our soil three of the most diverse varieties of the human species. Two of these have been introduced within a recent historic period; the third has dwelt in the land during a lapse of time which may be estimated only by the geologist; yet we find to-day among the autochthons a much higher death-rate than among the exotic races. From the census of 1880 we learn that the death-rate—*i. e.*, the number of deaths during the year to one thousand of population—is for the three races as follows: Europeans, 17·74; Africans, 17·28; aboriginal Americans, 23·6.

Now the question arises, To what particular cause or causes is this high rate of mortality among the Indians especially due? On this point the Tenth Census seems to leave us not a moment in doubt. In Vol. XI—that on "Vital Statistics," by Dr. J. S. Billings, U. S. A.—we find a table (14) and a diagram (p. xxxvii) showing for whites, colored, and Indians, the proportions of deaths from specified diseases in one thousand deaths from known causes. The diagram is based on the table; but I will allude more to the former, since it gives at a glance the solution to our question. In this diagram there are twenty causes of death specified, and under each the three races are indicated by spaces differently shaded.

Under the heading of "Other Diseases of the Respiratory System" the mortality of the red and black races is about the same. Under eleven headings the black exceeds notably the red in mortality. Only under eight heads does the red notably exceed the black in its death-rate. Six of these are: accidents, diarrhœal diseases, measles, affections of pregnancy, scrofula and tabes, and venereal diseases. Of the latter Dr. Billings says (*op. cit.*, p. xxxvi): "The high proportion of deaths among the Indians which is reported as due to venereal diseases is noteworthy, but probably a part of this is due to a greater readiness to name the true cause among these people than exists among the whites."

From my own experience of the ease with which Indian women travail, and the universal corroborative testimony of explorers and eth-

nographers, I marvel at the figures given under "affections of pregnancy," which, though not forming an important factor in the Indian death-rate, seem more fatal to the Indian than to the negro. In diarrhœal diseases the Indian rate is not greatly in excess of that of the other classes. Measles, although most fatal in the Indians, gives a mortality of only 61·78 in a thousand. Notwithstanding the perils of a hunter's life, and of life under any circumstances on the frontier, we find that in deaths from injuries, although the rate for Indians is more than that for whites, it is less than for the colored race. But it is under the head of consumption that the Indian column is seen to rise conspicuously from 186 in the colored race to 286 in the Indian. A glance at the diagram shows that this is their specially fatal disease. Scrofula and tabes, being so closely allied to consumption, the numbers under this heading do little more than add to the testimony regarding the prevalence of the latter malady.

Comparing the Indian and white races, we find that from ten of the twenty causes the mortality of the latter is notably greater, under two headings it is nearly the same, and again we see under the title "Consumption" the Indian column rising far above the white, which is about 166 in a thousand—*i. e.*, 20 less than the colored.

The probable inaccuracy of these Indian statistics is fully recognized in the Report, and it may be fairly urged in many cases, but with less justice, I imagine, with regard to consumption than with regard to many other causes of death. In its earlier stages consumption is a malady which often only the most skilled diagnostician can detect; yet in its later stages it is easily recognized. Above all, a death from consumption—using the term in the broad sense, in which it is necessarily employed here and in the vital statistics—is rarely assigned to another cause even by the layman.

We will next endeavor to determine if this disease always existed among the Indians to the same extent that it does now, or if it has increased of late years under the influence of the many complex causes which, not clearly analyzing, we are accustomed to epitomize in the expression "contact with civilization."

My own professional experience among our American aborigines includes a period of twenty-one years, and was gained among the Indians of a dozen different States and territories. Wherever I have sojourned I have always made it a point to give my professional services to Indians ungrudgingly and gratuitously, and for this reason I have had as good opportunities for observing their ailments as usually fall to the lot of the civilized physician. In no place where

I have practiced among them have I failed to observe or learn of cases of consumption except in Owen's Valley, California, a locality which is favored with perhaps the most salubrious climate within our borders. It may have existed there, but it did not come to my knowledge during a residence of nearly one year in an Indian population of about eight hundred. Yet even here symptoms of scrofula were not entirely wanting.

My first experience with Indians as a physician was among some of the wildest tribes then existing on our continent, among those least influenced by civilization, prosperous, well nourished, dwelling in the heart of the buffalo-range, and in what has proved to be—since the days of white occupation and the advent of the census-taker—a very healthful climate, the climate of the upper Missouri and Yellowstone Valleys. With certain preconceived notions of the healthfulness of the free out-door life and simple diet of the savage, and a conviction of the salubrity of the dry and elevated plains on which I found him, I was astonished to find that such a disease as consumption existed at all, and still more astonished to find it by no means infrequent.

As the years went by, and it fell to my lot to revisit, at long intervals of time, tribes which I had known in earlier days, I became impressed with the idea that this disease was on the increase among them. I well knew how easily I might be deceived in this matter. It was not in my power to collect complete data. I could only draw conclusions from the cases falling within my personal experience, and this experience was subject to limitations which had nothing to do with the prevalence of the disease. In former days the Indians had great confidence in their own shamans and little in white physicians hence they consulted us less then than at present. In the old times they were wealthy and could afford to pay their extortionate medicine-men for their mummeries; in latter years their poverty compelled them to seek treatment which they could obtain for nothing. Furthermore, when they subsisted largely by hunting, they were much of their time abroad on the prairies and less under our observation.

Notwithstanding the possibility of my being led astray, it seemed evident to me that consumption increased among Indians under civilizing influences, and that its increase was not in a direct ratio to that of other diseases, but in a constantly augmenting ratio—again, that it varied greatly in different tribes.

I should have hesitated, however, to occupy your time with a recital of my convictions or impressions, based on personal experi-

ence, were it not that of late years some data have been collected which tend to strengthen them.

As the census reports for 1880 give the vital statistics for one year only, they can not afford any direct evidence as to the increase or decrease of any disease among Indians from year to year; but they give us some data from which we may draw reasonable inferences. They present us with two sets of tables for the Indians—one for those living on reservations, the other for those not on reservations, whom I will call Indians at large. Over two thirds of the latter class live in the States, less than one third in the territories. The Indians at large who reside in the States may broadly be said to represent those who have been brought most fully under the influence of civilization; those dwelling in the territories are for the most part residents of the most healthful sections within our borders (for instance, several thousand of the Pueblos of Arizona and New Mexico are included), and they must serve to reduce considerably the general death-rate and the consumption-rate of the class to which they belong. (By "consumption-rate" I mean the number of deaths from consumption in a thousand deaths from all known causes.) The reservation Indians, on the contrary, with some minor exceptions, are those who have been most recently subdued and brought under civilizing influences.

Let us compare the consumption-rates of these two classes. The rate for the reservation Indians is 184; that for the Indians at large is 373. In other words, the consumption-rate for the less civilized Indians is but 49 per cent. of that of the more civilized. But it may be urged that these figures are not so conclusive as they might, at the first glance, appear to be in determining the mere influence of civilization, since we have not taken into consideration the general consumption-rate of the different localities where the Indians in question are found, and it would be impossible to do so with any accuracy from the published data. I have, however, had access to some of the original reports, in manuscript, from which the statistics of the reservation Indians are drawn, and with these to aid me I have been able to compare the consumption-rates of different local groups of Indians with one another, and with the surrounding general consumption-rate. As far as I have instituted such comparisons, they seem to increase rather than diminish the force of the civilization factor.

The following is the consumption-rate among reservation Indians in thirteen different States and territories: Nevada, 45; California,

70; Arizona, 83; Colorado, 107; Nebraska, 150; Montana, 176; Dakota, 200; Oregon, 240; Idaho, 250; Washington, 302; Michigan, 333; Wisconsin, 361; New York, 625.

It is seen in the foregoing table that in States east of the Mississippi—the oldest States—where the Indians have been longest under civilizing influences, the consumption-rate is the highest.

Now, the general consumption-rate of Dakota is 94, that of the rural districts of New York 152—much less than twice as great; while the Indian consumption-rate of New York is three times that of Dakota. Of the younger States and territories Washington has the highest Indian consumption-rate, yet it is only half the rate of New York, while the general consumption-rate of Washington (136) approximates that of New York closely. Of the States east of the Mississippi, Michigan has the lowest Indian consumption-rate, yet its rate is higher than that of Washington, while its general consumption-rate (137) is about the same. Again, take Wisconsin, in which the Indian consumption-rate is higher than in Washington, and the general consumption-rate (109) is lower.

In the office of the Indian Bureau in Washington, D. C., I have examined some of the reports of the agency physicians from the beginning of the fiscal year ending June 30, 1875, to the end of the fiscal year ending June 30, 1880. It becomes apparent in examining these reports that they are often very imperfect. In some it is evident that no deaths are recorded except those happening to occur in the practice of the physician—a practice often exceedingly limited. Again, there are often long hiatuses of many months in the series of reports, occasioned by the removal of a physician from office and tardiness in furnishing a successor. It is to be regretted, too, that it has not been always the policy of the Interior Department to furnish the Indians with regular medical graduates to treat their diseases and report on their sanitary condition. Still we may conclude that the reports are of some value for purposes of comparison. It is probable that they do not record proportionally more deaths from consumption than from other causes—in short, it is to be supposed that the consumption-rates are comparable.

Proceeding on this supposition, I have computed this rate for two sub-tribes of the great Dakota nation—subtribes of the same blood, not expatriated, living in climates not materially different from those which they have enjoyed for a century, and differing from one another only in degree of civilization. These are the people of Santee Agency, Nebraska, and those of Pine Ridge, Dakota. The former

are much the more civilized. Many of them have taken lands in severalty, and are citizens of the United States. Nearly all the adults read and write, wear clothing like ours, and are professing Christians. In the fiscal year of 1875 the consumption-rate of Santee was 631, that of Pine Ridge but 96; in the fiscal year of 1880 the rate of the former was 294, while in Pine Ridge no deaths were reported from consumption (but only 6 deaths from all causes in a population of over 7,000 are reported). In comparing, however, the statistics of Santee with those of Rosebud Agency, where there is another community of wild Dakotas, we find the showing for the civilized Indians not so bad. In the fiscal year of 1875 the wilder Indians had the lower consumption-rate (476 to 631), but in 1880 they had the higher rate (388 to 294).

As exhibiting progressive change in the consumption-rate in any one locality, the period of six years referred to above is too short. As far as I have worked out the consumption-rate for more than two years, I have found such great fluctuations that I do not hope for good data for generalization in so brief a period. I have, however, selected the reports from two Dakota agencies, Fort Berthold and Cheyenne River, hoping they might afford us some basis for an opinion. I have chosen these agencies for the simple reason that I have knowledge of the agency physicians, and feel confidence in their reports. The rate of Fort Berthold, computed from the records of the Indian Office, is as follows: For the fiscal years ending June 30, 1875, 41; 1876, 538; 1877, 500; 1878, 250; 1879, 133; 1880, 187.

Here we see that the rate of 1880 is considerably greater than that of 1875, but that during three of the intermediate years the rate is higher than in the last year.

For the rate of Cheyenne River I am indebted to the courtesy of my old and valued friend, Dr. C. E. McChesney, formerly agency physician and now Indian agent at Cheyenne River. The rate is as follows: For the calendar years 1878, 407; 1879, 550; 1880, 425; 1881, 417; 1882, not given; 1883, 561; 1884, 639; 1885, 649.

Here we find that, excepting a slight fall in 1880 and 1881, the increase in the consumption-rate is constant and marked.

In all the examples I have given I have endeavored to select tribes whose climatic environment has not been materially changed since the advent of the white man. The tribes of the Indian Territory, who are largely immigrants in that section, and other removed tribes, have been excluded.

If the evidence adduced is admitted to have value, it goes to show that consumption increases among Indians under the influence of civilization—*i. e.*, under a compulsory endeavor to accustom themselves to the food and the habits of an alien and more advanced race —and that climate is no calculable factor of this increase.

It might be supposed that after many years of contact with this civilization, after several generations of "survival of the fittest" to cope with the new condition of things, and after no small dilution of the Indian blood by intermarriage with the exotic races, a state of tolerance to this disease would be produced; but the consumption-rate of the Indians of New York seems to indicate that a century is not time sufficient to establish such a tolerance.

Although I am not without some theories, based on personal observation, as to the special causes of this excessive tendency of the Indian race to consumption, I have not been able, in the brief hours I have devoted to this paper, to explain these theories fully, and show how they may be tested by the light of external evidence. Perhaps it is not necessary that I should do so before a body who are here to investigate chiefly the influence of climate. The term civilization is too broad, too inexact. What particular element of this civilization is the baneful one? is the question which will naturally be asked. Why does this civilization affect the Indian differently from the negro, who has as lately been introduced to its chastening influence, and is surrounded by conditions even more unsanitary? Recent investigations have demonstrated that the old notion of the red race being a dying race is incorrect. Ethnologically, it is a disappearing race; biologically, it is a living and increasing race. But, even if it were a dying race, why should consumption be its special enemy? Is it because of the meager rations of some poorly supplied agency? If so, why is it so prevalent in well-supplied agencies, and why most prevalent, or at least showing the highest rate, in New York, where the Indians are well-to-do, self-sustaining husbandmen? It is a general supposition on the frontier that it is change in diet which is the most potent remote cause of consumption among Indians. I have heard it said that hard bread killed more than hard bullets. It was a favorite expression of the late General Harney, the famous Indian fighter, that the cheapest way to settle the Indian question would be to take them all into New York and board them at the Fifth Avenue Hotel. His plan was excellent in more ways than one. I once knew a case of a previously healthy Indian camp of about two thousand people where, in one

winter, when the buffalo left their country and they subsisted on flour and bacon furnished by the Government, the majority were attacked with scurvy, and about seventy died of the disease. Fine flour and bacon have, no doubt, had their share in the destructive work. But the consumption-rate, I find, is high at agencies where the supply of fresh beef is liberal—to judge from the annual reports of the Indian Commissioner—and it is high among the Indians of New York and Michigan, who have as varied a diet as their white neighbors. "Idiosyncrasy of race" and a score more of theories, trivial and profound, might be advanced and shaken at the first question.

APPENDIX.

MEMBERS OF THE ASSOCIATION.

MEMBERS OF THE ASSOCIATION.

AIKEN, S. C.

Geddings, W. H.

ALBANY, N. Y.

Ward, Samuel B., 135 N. Pearl Street.

ANN ARBOR, MICH.

Palmer, A. B., University of Michigan.

ATLANTA, GA.

Miller, H. V. M., 43 Walton Street.

ATLANTIC CITY, N. J.

Reed, Boardman.

BALTIMORE, MD.

Donaldson, Frank, Sr., 108 Park Avenue.
Donaldson, Frank, Jr., 108 Park Avenue.
Van Bibber, W. C., 47 Franklin Street.

BOSTON, MASS.

Bowditch, V. Y., 113 Boylston Street.
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